



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

HARVARD UNIVERSITY



LIBRARY

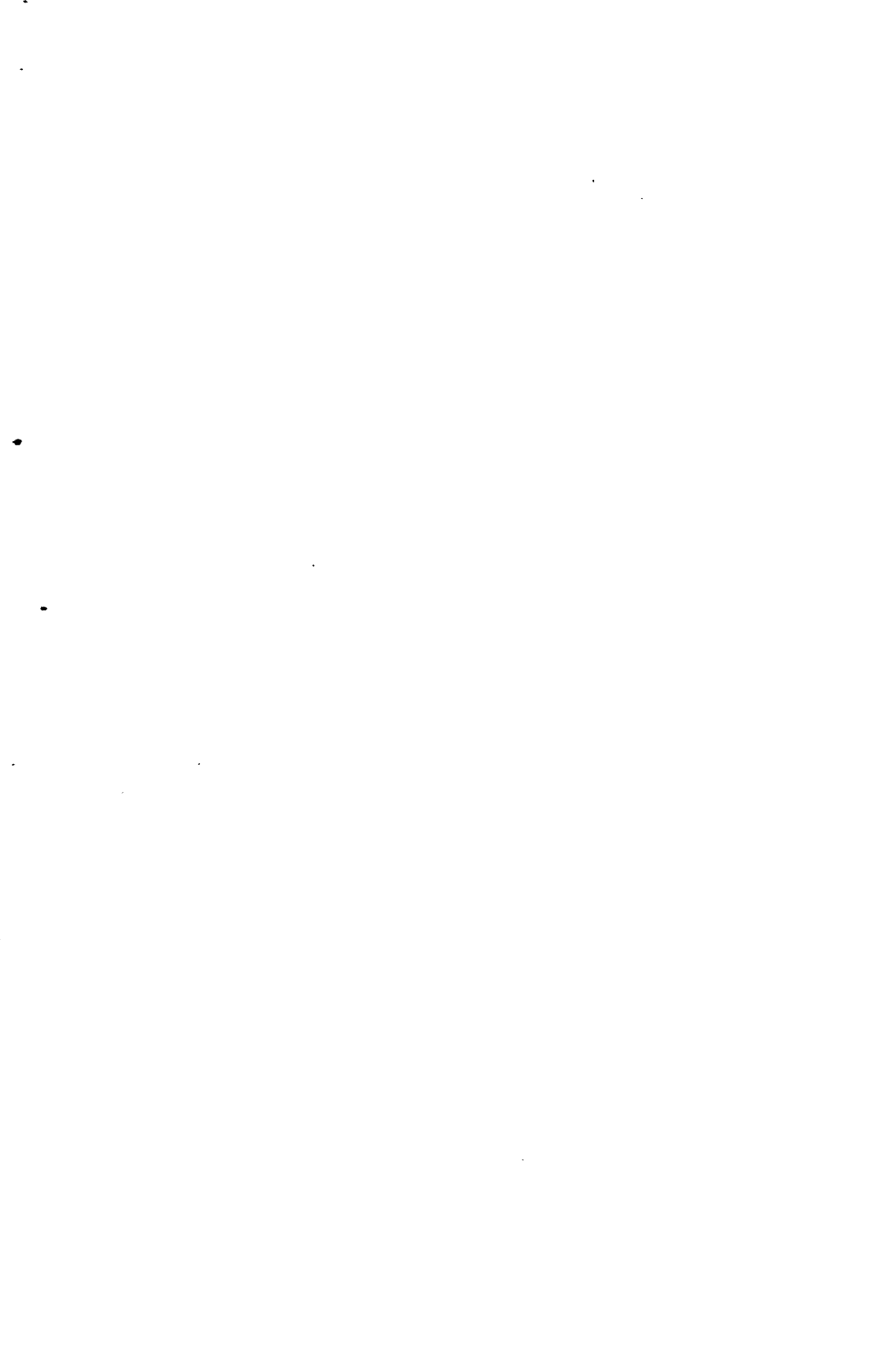
OF THE

PEABODY MUSEUM OF AMERICAN
ARCHAEOLOGY AND ETHNOLOGY

IN EXCHANGE WITH

The Society

Received **1907-08**



BULLETIN

OF THE

Wisconsin Natural History Society

VOLUME V

(NEW SERIES)

EDITED BY THE SECRETARY.

MILWAUKEE

1907

L. Soc. 120. 12. 16

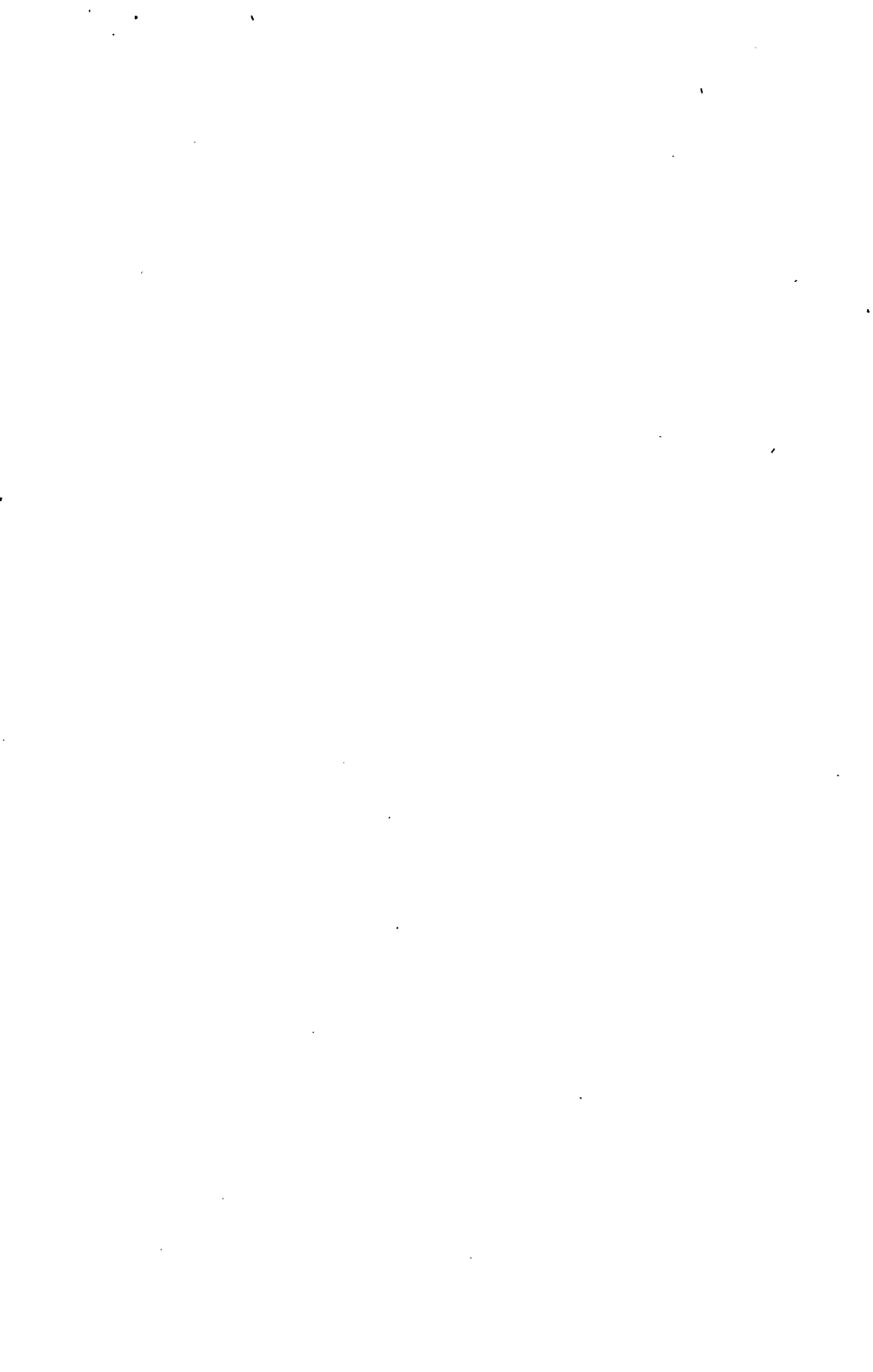
Exp. 100. 75: The Society

Dec. 1907 - 10

100
75
10

CONTENTS OF VOLUME V.

Proceedings	1
The Origin of Species. By Charles Otis Whitman.....	6
Wisconsin Flowers and Their Pollination. By S. Graenicher.....	15
New Chalcid-flies from Cape Colony. By Charles T. Brues.....	46
Notes and Descriptions of North American Parasitic Hymenop- tera. III. By Charles T. Brues.....	54
A Weasel New to Wisconsin's Fauna. By Henry L. Ward.....	63
Proceedings	65
Notes on a New Guest-ant (<i>Leptothorax glaciatus</i>) and the Varities of <i>Myrmica brevinodis</i> . By William Morton Wheeler.....	70
Wisconsin Flowers and Their Pollination. II. By S. Graenicher.	84
Notes and Descriptions of North American Parasitic Hymenop- tera. IV. By Charles T. Brues.....	96
On the Fertilization of the eggs of <i>Asterias</i> and <i>Arbaca</i> . By Ellen Torelle	112
A New Apiocera from South Africa. By A. L. Melander.....	125
Additions to the Lepidopterous Fauna of Milwaukee County. By Richard A. Muttkowski.....	128
Briefer Articles.....	134
Proceedings	139
Observations on the Nesting Habits of <i>Gorytes canaliculatus</i> , Packard. By George P. Barth.....	141
Notes and Descriptions of North American Parasitic Hymenop- tera. V. By Charles T. Brues.....	150
Briefer Articles.....	161
Correction	162
Proceedings	163
A Check List of the Flora of Milwaukee County. By Howland Russel	167
A New Species of <i>Psen</i> . By Henry L. Viereck.....	251
On the Nesting Habits of <i>Psen barthi</i> . By George P. Barth.....	251
List of Members of the Wisconsin Natural History Society.....	258



INDEX TO VOLUME V.

New species and new names are marked with an asterisk.

<i>Acrisis americanus</i> *	160
<i>Alcidamea producta</i> , habits of	2
<i>Allium canadense</i> , pollination of	24
<i>Allium cernuum</i> , pollination of	25
<i>Allium tricoccum</i> , pollination of	23
<i>Anastatus laticeps</i> *	107
<i>Anastatus longiceps</i> *	108
<i>Apiocera braunsi</i> *	126
<i>Apiocera haruspez</i> , note on	125
Arbacia, fertilization of eggs of	112
Archæology of French Quaternary, note on	134
<i>Asobara barthi</i> *	57
<i>Asparagus officinalis</i> , pollination of	31
Asterias, fertilization of eggs of	112
Barth, George P., note by	4
Barth, George P., on <i>Condidea lata</i>	161
Barth, George P., on the habits of <i>Psen barthi</i>	237
Barth, George P., on nesting habits of <i>Gorytes canaliculatus</i>	141
Birds, color of	1
Brues, C. T., Lecture by	66
Brues, C. T., on New Chalcid flies	46
Brues, C. T., on North American parasitic Hymenoptera	54, 96, 150
<i>Callidiotes kansensis</i> *	55
<i>Calyptus collaris</i> *	159
Cape Colony, New chalcididae from	46
Case, E. C., lectures by	3, 66
<i>Chalcedotes texanus</i> *	106
Chalcid flies from Cape Colony	46
<i>Charitopus albopalpis</i> *	47
Check list of flora of Milwaukee County	167
<i>Chelogyne scaefferi</i> *	101
<i>Chryseida inopinata</i> *	103
<i>Clintonia borealis</i> , pollination of	32
<i>Cœlinus longulus</i> Ashmead	58
Colles, George W., note by	68

Colors of birds.....	1
<i>Condidea lata</i> Coq., occurrence in Wisconsin.....	161
Convallariaceæ, pollination of.....	15
Crabro, habits of.....	4
<i>Dinotrema soror</i> *.....	59
Doerflinger, Chas. H., Article by.....	134
<i>Eophylus texanus</i> *.....	111
Eggs, incubation of.....	5
Elephant, phylogeny of, lecture on.....	67
<i>Epyris fulgens</i> *.....	99
Epyris, table of North American species of.....	96
<i>Erythronium albidum</i> , pollination of.....	29
<i>Erythronium americanum</i> , pollination of.....	30
<i>Eupelminus robustus</i> *.....	50
<i>Eupelmus cursor</i> *.....	52
<i>Eupelmus melanderi</i> *.....	54
<i>Eupelmus nudifer</i> *.....	51
<i>Eupelmus volator</i> *.....	52
Flora of Milwaukee County.....	167
Geological development of scenery, lecture on.....	3
<i>Gonatocerus americanus</i> *.....	109
<i>Goniozus hortorum</i> *.....	150
Goniozus, table of North American species of.....	151
<i>Gorytes canaliculatus</i> , nesting habits of.....	141
Graenicher, S., note by.....	2
Graenicher, S., on pollination of flowers.....	15, 84
Grossulariaceæ, pollination of.....	89
<i>Hadronotus robustus</i> *.....	156
<i>Heloon ferrugineus</i> *.....	158
<i>Heuchera hispida</i> , pollination of.....	86
<i>Hoplogryon grandis</i> *.....	102
<i>Hormiopterus caudatus</i> *.....	62
<i>Hormiopterus claripennis</i> *.....	61
<i>Hormiopterus</i> , North American species of.....	60
<i>Ichthyechinus corbis</i> , note on.....	140
<i>Ignotus enigmaticus</i> , note on.....	140
Incubation of eggs.....	5
Instinct of bees, variation in.....	2
<i>Kapala furcata</i> Fabr.....	105
King Eiders at Milwaukee, a correction.....	136
Lepidoptera of Milwaukee County, additions to list of.....	128
<i>Leptothorax emersoni glacialis</i> *.....	71
Liliaceæ, pollination of.....	15
<i>Lilium canadense</i> , pollination of.....	26

<i>Lilium umbellatum</i> , pollination of.....	28
List of Members of Society.....	258
<i>Macroteleia surfaceti</i> *.....	153
<i>Macroteleia</i> . table of North American Species.....	154
Megachile, habits of.....	2
Melander, A. L., on a new Apiocera from South Africa.....	125
Melanthaceæ, pollination of.....	15
Members of society, list of.....	258
<i>Metopius birkmani</i> *.....	56
Micas, Classification and origin of.....	68
Milwaukee county, flora of.....	167
Milwaukee county, Lepidoptera of.....	128
<i>Mitella diphylla</i> , pollination of.....	88
Museum collecting, address on.....	140
Mutation theory, discussion of.....	8
Muttkowski, R. A., List of Lepidoptera by.....	128
<i>Myrmica rubra brevinodis</i>	73
<i>Myrmica rubra brevinodis decedens</i> *.....	75
<i>Myrmica rubra brevispina</i> *.....	74
<i>Myrmica rubra canadensis</i>	76
<i>Myrmica rubra frigida</i>	78
<i>Myrmica rubra subalpina</i> *.....	77
Naosaurus, note on.....	66
North American parasitic Hymenoptera.....	54, 96, 150
Notes on a new guest-ant, <i>Leptothorax glacialis</i>	70
Origin of species.....	6
<i>Ormyrodes carinatus</i> *.....	47
<i>Orthopelma thompsoni</i> *.....	157
<i>Orthostigma americana</i> *.....	59
Oaks of Wisconsin, note on.....	139
<i>Pambolus dispar</i> *.....	110
<i>Parasterola bicarinata</i> *.....	100
Parasitic Hymenoptera of North America.....	54, 96, 150
<i>Parasolindenia aptera</i> *.....	49
Permian reptiles, note on.....	66
<i>Phlyctænacanthus telleri</i>	3
<i>Phorbas longicornis</i> *.....	152
Pigeons, evolution of.....	12
Proceedings of society.....	1, 65, 139, 163
<i>Psen barthi</i> *.....	237
<i>Psen barthi</i> , habits of.....	237
<i>Putorius riosus alleghenhensis</i> (Rhoades).....	63
Reptiles, fossil, note on.....	66
<i>Ribes cynosbati</i> , pollination of.....	92

<i>Ribes floridum</i> , pollination of.....	95
<i>Ribes gracile</i> , pollination of.....	93
<i>Ribes oxycanthoides</i> , pollination of.....	91
<i>Ribes rubrum</i> , pollination of.....	90
Russel, Howland, note by.....	139
Russel, Howland, on the Flora of Milwaukee County.....	167
<i>Salomonina biflora</i> , pollination of.....	39
<i>Salomonina commutata</i> , pollination of.....	41
<i>Saxifraga pennsylvanica</i> , pollination of.....	84
<i>Schizaspidia septentrionalis</i> *.....	104
<i>Scopiorus monticola</i> *.....	56
<i>Sparaision gregarium</i> *.....	154
Sparaision, table of North American species.....	155
Species, origin of.....	6
<i>Streptopus roseus</i> , pollination of.....	38
Strong, R. M., lecture by.....	1
<i>Tofieldia glutinosa</i> , pollination of.....	20
Torelle, Ellen, on fertilization of echinoderm eggs.....	112
Transmission of diseases by insects.....	66
<i>Trillium cernuum</i> , pollination of.....	44
<i>Trillium erectum</i> , pollination of.....	43
<i>Trillium grandiflorum</i> , pollination of.....	42
<i>Trillium nivale</i> , pollination of.....	43
<i>Trillium recurvatum</i> , pollination of.....	45
<i>Unifolium canadense</i> , pollination of.....	37
<i>Uvularia grandiflora</i> , pollination of.....	21
<i>Vagnera racemosa</i> , pollination of.....	34
<i>Vagnera stellata</i> , pollination of.....	35
<i>Vagnera trifolia</i> , pollination of.....	37
Viereck, H. L., on a new species of <i>Psen</i>	237
Ward, H. L., on a new Wisconsin Weasel.....	63
Weasel new to Wisconsin.....	63
Weasel skins, exhibition of.....	67
Williston, S. W., lecture by.....	67
Wheeler, W. M., on a new guest-ant.....	70
Whitman, C. O., lecture by.....	5
Whitman, C. O., on the origin of species.....	6

BULLETIN

OF THE
WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 5, New Series.

JANUARY, 1907.

No. 1.

PROCEEDINGS.

Milwaukee, Oct. 25, 1906.

Regular monthly meeting of the Society.

President Teller in the chair and 73 persons present.

Mr. Teller stated that there had been considerable comment on the part of various members of the Society regarding the advisability of holding monthly section meetings, and asked for expressions of opinion.

Dr. Barth moved that a section meeting be held on the second Thursdays of the months when regular meetings are held, and that these meetings be set aside for scientific discussion and restricted to such. Motion seconded and passed.

The following persons were named for membership:

Miss Ellen Torelle.

Mr. George Wetmore Colles.

Dr. Albert H. Brundage.

Mrs. A. Bernhardt.

These names were referred to the Board of Directors, who subsequently passed on them.

There being no further business, Dr. R. M. Strong, of the University of Chicago, spoke on the Colors of Birds.

The speaker said that in addition to their importance as characters in taxonomic work and in studies of evolution and heredity, the colors of birds are interesting because of numerous problems in physics that they present. Two categories of colors are recognized, viz: pigmental and structural. To the former belong black, red, orange, yellow, and green (occasionally). Structural colors include white, blue (except for one case of pigmental blue described by Häcker), and iridescent effects. White feathers owe their color to the entire absence of pigment. The whiteness of feathers is produced in the same way as the

whiteness of snow or of other transparent substances in a fine state of division. Iridescent effects and blues are due to obscure physical phenomena which are not entirely understood. Grays are produced by combinations of the conditions which produce black and white.

President Teller thanked Dr. Strong in behalf of the Society for his entertaining address and for his kindness in coming to Milwaukee to lecture before the Society.

The meeting then adjourned.

Milwaukee, Nov. 8, 1906.

Combined meeting of the Biological sections.

President Teller in the chair and 12 members present.

As no topics for discussion had been announced and no program prepared, those present were loathe to start the proceedings. Finally, Dr. Graenicher called attention to two interesting cases of variation or mutation of instinct among bees. The first was *Ancidamea producta*, a species which hollows out stems, and the second a specimen belonging to a species of *Megac hile*. Both of these normally close the nest with a plug of malaxated leaf pulp, but in these two cases, out of a large number of nests observed, the female bees had used pieces of stone or gravel mixed in the pulp. He suggested that this was perhaps a mutation in habits, but that it was more likely an atavism, since the use of stones as building material was probably more primitive than the employment of leaves cut from plants.

Mr. Brues said he agreed that this might be looked at as a mutation of habit, but believed it was undoubtedly a reversion. He called attention to the bee genus *Anthidium*, certain species of which use plant material for their nests, while other very closely related ones utilize stone or gravel entirely, suggesting that the variation was perhaps not as profound as it would seem at first sight. Mr. Ward said that variations in nest-building among birds were common and often as striking as the cases among bees mentioned by Dr. Graenicher. He cited the Caspian Tern, a species which he had seen utilizing shells to line its nests, a very unusual habit, since it usually uses no lining except a little plant matter. At the same time, he said, the species had departed from its usual solitary habits and was nesting in great numbers, and with a second regularly gregarious species, the Herring Gull.

Mr. Teller then exhibited some specimens of the fossil fish-spine, *Phlyctanaacanthus telleri* Eastman. He called attention to the way in which the two spines fitted together and to the beautiful way in which the structure was preserved. Mr. Colles asked if any of the original organic matter was still present in such specimens, and Mr. Teller seemed inclined to believe that there was still some of it present. Mr. Colles thought it extremely doubtful, and believed that the original organic molecules were gone in their entirety to be replaced by those of inorganic origin. Mr. Brues mentioned a section of muscle taken from a fossil shark which he had seen, that when microscopically examined could scarcely be distinguished from poor sections which he had seen prepared in the laboratory by students unfamiliar with histological methods. He also said that organic matter and quite probably organic pigments and chitin were frequently preserved as fossils, citing a number of fossil Hymenoptera from the Tertiary rocks of Colorado. Here browns, pale colors and blacks are often distinctly differentiated and even the metallic blue characteristic of some species. Mr. Colles doubted the presence of the easily disintegrated chitin or organic pigments as such, but agreed that carbon at least must be present, but probably uncombined, and believed that the colors were due to some secondary cause.

After some discussion of a more general nature the meeting adjourned with the hope expressed that a special program might be prepared for the next section meeting.

November 22, 1906.

Regular meeting of the Society.

President Teller in the chair and 40 persons present.

Dr. E. C. Case lectured on the "Geological Development of Scenery," illustrated by stereopticon slides. Dr. Case described the several successive stages in erosion by rivers, aided by diagrams and photographs of natural scenery. Weathering and chemical disintegration as factors were also considered.

The general discussion was followed by a more detailed consideration of each individual factor, a series of slides illustrating their action and the various forces that may modify them.

The meeting then adjourned.

December 13, 1906.

Combined meeting of the Biological sections.

President Teller in the chair, and Messrs. Barth, Brues, Colles, Doerflinger, Finger, Graenicher, Russell and Ward present.

Dr. Barth opened the discussion with his observations during the past year on the habits of wasp of the genus *Crabro* observed in the vicinity of Milwaukee. The species collected were wood boring in habits, but Dr. Barth stated that very satisfactory breeding tubes could be made from small glass vials, a trifle longer than the natural cell, but of the same diameter. The larvæ are not easy to raise in captivity as the change of environment seems to affect them greatly. The number of flies carried in varies among individuals of the same species, the number being to some extent proportionate to the size of the flies. Some wasps seem to prefer large flies which they pack loosely in the brood-cell, while others select small ones which they store tightly together. He found that the duration of the egg stage was not always the same nor the time required for forming the cocoon. In carrying the captured flies the Crabros usually grasp them between the hind legs with some assistance from the middle pair of legs. They hold the prey very tightly, going with it into the nest head first. On a number of occasions after opening nests he found that the flies were able to move about and even crawl away. The fly upon which the Crabro's egg is placed was, however, never found to be alive. Dr. Barth also gave a list of the species of flies carried in, mentioning especially a *Tachina* fly (*Winthemia 4-pustulata*), and two species of *Acroceridæ* belonging to the genus *Oncodes*. Regarding the arrangement of the cells and galleries in the wood, Dr. Barth said that they were usually spiral, not always following the line of least resistance. There is usually a main gallery with smaller branches leading to the cells. The stinging habits of the Crabros were found to be simple, the fly being stung on the ventral surface of the thorax. When stuck by a needle in the same place, the speaker found that they were affected in nearly the same way, later reviving. When returning with their flies, the Crabros are never in a hurry to enter the nest, thus giving ample time for parasites to lay their eggs. In some cases Dr. Barth was sure the parasite must enter after the Crabro egg had been already laid. He had a number of parasites obtained from the various Crabros studied.

After the speaker had finished his remarks, Dr. Graenicher said that he had been rather surprised to hear that species of *Tachina* flies were captured by the Crabros, as he had often observed how easily

certain of them eluded the sand-wasps belonging to the genus *Bembex*. Mr. Brues remarked that *Winthemia 4-pustulata* was an unusually weak and soft-bodied Tachinid. Mr. Colles asked if it were always the case that parasites were never regularly captured or destroyed by their hosts. This occasioned some discussion. The general opinion was that Tachinids and other parasites as well were never, or at least very rarely captured by the host species, no matter how annoying they might be, or how many attempts were made. Mr. Brues suggested that this was a necessary provision for the perpetuation of the parasitic species and that it must be very strongly accentuated by natural selection.

Dr. Graenicher next described a peculiar variation of instinct in a species of *Crabro* that he had observed several years ago late in the season. The female in question had built several nests, one on top of another in a hollow stem without laying any eggs in any of the cells. He also spoke of certain experiments by the French naturalist Fabre who had succeeded in getting certain bees to build nests in glass tubes in his study. He suggested that this would be an interesting way to study the habits of Dr. Barth's *Crabros*, if they could be induced to nest under such conditions.

Mr. Ward then asked if as a general rule the time required for the eggs to hatch, when incubated by the parent birds and in artificial incubators, was the same. Messrs. Barth, Graenicher, Colles, Russell and Brues joined in the discussion which followed. The general agreement was that only slight differences in the incubation period were produced by variable temperature.

The meeting then adjourned.

Milwaukee, December 20, 1906.

Regular monthly meeting of the Society.

President Teller in the chair and about 60 persons present.

The minutes of the last monthly meeting were read and approved.

Professor C. O. Whitman, of the University of Chicago, gave the lecture of the evening on "The Evolution of Species," the text of which appears on the later pages of the Bulletin.

After the lecture President Teller thanked Professor Whitman in behalf of the Society for his kindness in presenting his interesting talk.

The meeting then adjourned.

The following papers were ordered printed by the board of directors:

THE ORIGIN OF SPECIES.*

By CHARLES OTIS WHITMAN.

Much has been said and written on the subject of the origin of species, but tradition was first to claim possession of the secret and to veil it with such unapproachable guile of devination, that the world waited until the middle of the nineteenth century for a Darwin to vindicate the right of investigation. The many-sided problem was at length revealed in 1859. It was a problem to challenge at once the most lively interest not only among biological investigators, but in every department of science and thought. The half century since the appearance of Darwin's great work on the "Origin of Species," has effected a more wonderful revolution in our modes of thought and investigation than anyone can realize who has not lived in close touch with every year's progress.

The dogma of special creations has exhibited most stubborn tenacity, but it has slowly yielded to the principle of progressive evolution guided by the operation of natural laws. The violent shock experienced by theologians at seeing natural selection set in the place of Creative power, the revulsion at the thought of universal kinship in the organic world, especially at the doctrine of man's descent from lower forms of life—all this lingers only as reminiscence, and we now find satisfaction in viewing the history of our race as a grand series of ascending stages, and take more pride in a rising ancestry than in a fallen one.

The revolution in sentiment has well-nigh freed us from supernaturalism. Investigation has multiplied and intensified at an increasingly rapid rate, but the problem of the origin of species has not been more than partially solved. In fact, it seems as if Darwin and Wallace, Nägeli, Haeckel, Dohrn, Weismann, De Vries and a host of other investigators, had grappled with an all-embracing problem—a problem of problems that must engage the best energies of all the sciences for centuries yet to come.

*The introduction and abstract of a lecture delivered before the Wisconsin Natural History Society by Professor Whitman at the meeting of December 20, 1906.

The era now dawning presents us with two leading rival theories. From Darwin and Wallace we have received the theory of *Natural Selection*, which has been powerfully supported by Spencer, Huxley, Haeckel, Weismann, Dohrn, and many others. This theory and its triumphs are familiar history.

In 1901, Hugo De Vries, a distinguished botanist of Amsterdam, brought forward his famous Mutation-theory, based upon "*Experiments and Observations on the Origin of Species in the Plant Kingdom*."

This work of De Vries is truly a great achievement, rising above any other that has appeared since Darwin's "Origin of Species." It is not only comprehensive in scope, consistent in its logic, and charming in style, but it is also epoch-making in its method of research. In this latter respect it sets an example which is having a world-wide influence—emphasizing as it does the supreme importance of *studying living organisms and of keeping observations and experiments running continuously through a long sequence of generations*.

This is the method of the new era in biology—steady unbroken continuity in experiment under controlled culture. Here the example of Mendel, De Vries, and a few others, will be potent for many years to come.

As to the real merit of the theory of mutation, only extended research can bring a final decision. In dealing with such a theory, we must grasp clearly its fundamental conceptions. The whole superstructure stands or falls with them. The central foundation-idea of this Mutation-theory is that of *unit-characters*. The species represents always a definite number of distinct unit-characters, each as distinct and independent as are the elements of a chemical compound. Consequently all upward progress in the organic world depends upon *adding new unit-characters*. Furthermore, these unit-characters are held to be essentially unchangeable, and hence the species compounded of them are viewed also as essentially immutable. A unit-character, it is true, may undergo transmutation, i. e., it may become a wholly new unit-character. Such transmutation, however, is always *sudden*, never by slow *intermediate* degrees. Any slow and gradual transition, such as Darwin and Wallace maintained, never under any circumstances, according to De Vries, could lead to the formation of a new species. The utmost that could be attained by such variation

would be only an improved race, i. e., merely a better kind of the same species—a kind that remains better only so long as cultivated under favored conditions, reverting to the common level as soon as left to itself under normal conditions.

To remove any doubt as to these points, let me cite a few passages from De Vries:

(1) "I designate as mutation-theory the proposition that the characters of organisms are built up of units sharply differentiated one from another. These units may be combined in groups, and the same units and groups occur in allied species. *Transitions, such as we so often see in the external forms of plants and animals*, do not exist between these units any more than between the molecules of chemistry." Vol. I, p. 3.

(2) "In the field of the doctrine of descent, this principle leads to the conviction that species have not arisen one from another by *flowing transitions*, but by distinct steps. Every new unit added to the older units, forms a step, and separates the new form, as an independent species, sharply and completely from the species out of which it arose. The new species thus comes into being at a single stroke. *It arises from the earlier form without any visible preparation, without transitions.*"

(3) "The mutation-theory, in my opinion, is supreme not only in the doctrine of the origin of species, but also in the whole field of hybridisation. Here it conducts us to the principle, that not the species, but *the simple specific characters*, the so-called elements of the species, *are the units with which we deal in hybridisation.*"

(4) "Every character, it is true, arises from one already present, not however from its *normal variation*, but through a change which, however small, is yet sudden. Provisionally, this change may be most simply likened to a *chemical substitution.*"

In his preface, p. IV., as follows:

(5) "These jumps, or mutations, of which sport-variations are the best-known examples, form a special part of the subject of variation. They occur *without transitions*, and are *relatively rare*, while ordinary variations are *continuous and always present*.

(6) "The whole subject of variation thus divides into two parts, one of which deals with the ever present, individual, or fluctuating variation, the other, with mutation. Phenomena of the first class obey the well-known laws of probability and depend

essentially upon food-conditions; upon them depends the formation of improved races, especially in agriculture. Not only *species*, but also *varieties* arise by mutation."

(7) "Species have not arisen through gradual selection, continued for hundreds or thousands of years, but by jumps (*stufenweise*) through sudden though small, transformations. In contrast with variations which are changes advancing in a linear direction, the transformations to be called mutations diverge in new directions. They take place, then, so far as experience goes, *without definite direction*." (Vol. 1, p. 150).

(8) "Species-forming variability must be orderless. The assumption of a definite variation-tendency which would condition, or even favor, the appearance of adaptive modifications, lies outside the pale of the natural science of to-day. In fact, the great advantage of Darwin's doctrine of selection lies in this, that it strives to explain the whole evolution of the animal and plant kingdoms without the aid of supernatural presuppositions. According to this doctrine, species-forming variability goes on without regard to the qualification of the new species for maintaining themselves in life. It simply supplies the struggle for existence with the material for natural selection. Whether this selection takes place between individuals, as Darwin and Wallace supposed, or decides between whole species, as the mutation-theory demands, ultimately it is, in either case, simply the ability for existence under given external conditions that decides upon the permanence of the new form." (p. 180).

The fundamentals in the mutation theory, then, are:

1. Every species consists of a *fixed number* of *unit-characters*.
2. The species and the component units are alike sudden in origin and unchanging in type.
3. Old characters may be suddenly transmuted into new ones, but between the two there is always a gulf of absolute discontinuity, with no possible bridge of gradual modification.
4. Continuous intergradations may connect a species with an improved race, but never one species with another species.
5. Species-formation is kaleidoscopic, i. e., chance-wise in direction, never resulting from a tendency to vary in any one determinate direction.
6. Natural selection can not give origin to new species; it can only weed out from those already in existence such as are incapable of sustaining themselves.

Perhaps it may seem rash to assert that in no one of these six points does the mutation-theory hit the mark; nevertheless, that is the conviction from which I see no escape.

The one error that vitiates all these contentions is that of unit-characters, each of which is supposed to enjoy a sort of independent existence, although in correlation with the other units of the organism. Such a conception implies that every character of the adult organism pre-exists in some rudimentary form in the germ-cell from which the organism develops. These assumed rudiments of unit-characters must be as fixed in number and constitution in the fertilized egg as in the adult. Moreover, unless we assume that these units may mutate at any stage of development, we must suppose that all mutations destined to appear in the adult must originate in the very first stage of existence of the primordial units. Thus mutation would be carried back to the pre-mutation forever beyond the reach of investigation. Such conceptions, help us in no wise to understand the origin of species. To claim that we can actually see mutation performed, is the climax of absurdity.

De Vries has seen offspring differing more or less constantly from the mother plants. These visible differences are referred to invisible differences in one or more of the invisible unit-characters conjectured to exist in the seed before germination. The initial differences, in which, *ex hypothesi*, the whole mutation is given, De Vries has never seen and of course never expects to see. If there be any such thing as mutation, as conceived by De Vries, it is safely beyond human ken, and unapproachable through experimental investigation.

This theory of mutation coincides well with Bateson's doctrine of *discontinuity* in evolution and development. Discontinuity in evolution has all the elusiveness of mutation. The discovery of such a negative is tantamount to a failure to discover anything. A new form appears; it differs in one or more respects from its parents. The difference is labelled a discontinuity, i. e., the offspring is assumed to have obeyed the law of heredity in so far as it resembles the parental stock, and to have jumped hereditary bonds in so far as it departs from such resemblance. The jump is a break in the chain—a void where eyesight fails and all sorts of ghost-stories are accepted in lieu of reliable knowledge of all the antecedent conditions represented in the ancestry.

The less we know of the previous history of new forms, the

more we rely upon the testimony of casual observers who merely report what they stumble upon without knowing the requirements of thorough investigation, the more "discontinuities" and mysterious saltations we encounter. One continuity properly demonstrated, outweighs myriads of mythical discontinuities.

It is well to bear in mind always that there is no evolution of organisms apart from the development of individuals. *The evolution of a species is but the summation of achievements in individual development.* Consequently, if we would know whether evolution is discontinuous or continuous, we must get our direct evidence from development as we now find it going on. If in any series of developmental stages, we find a single stage that is not causally connected with preceding stages, we may pause and ask, what is the use of investigating amid miracles of discontinuity?

In embryological development we find continuity and order of sequence regnant throughout. There are no kaleidoscopic leaps to interrupt the sequence. The course followed is, in the main, the one anticipated in the hereditary foundations of the germ. The flow of events may swerve this way or that, but nowhere is there a gulf breaking the connection between antecedents and consequents.

Of course species are sooner or later separated by gaps. But are these gaps present *ab initio*? The claim of initial discontinuity is usually founded on so-called "sports," the preparatory stages of which were overlooked, or very imperfectly investigated. This is not the kind of evidence on which to establish a general theory. If discontinuity or mutation were the law in the origin of species, *continuity should not be expected in a single case*, as De Vries has clearly perceived. Hence he has taken care to deny the possibility of getting new species through ordinary variation. In such variation continuity is undeniable. Hence the whole reliance is placed on "Sports," and "improved races," however true they breed, are not admitted to the rank of species.

We see then how very important it is to make our investigation of the origin of species exhaustive. We have to select well our material for study, and then attend closely to some one character at a time. This means that we must work with living forms, which we can keep under unbroken control from generation to generation.

Then we must not stop here, but extend our observation over

as many allied species as possible, and endeavor to get the past history of the character. To experiments in breeding we must add those of crossing, as in this way we can best see whether a character is an indivisible unit, that admits of no transmutation by continuous modification. It is by such study that we may arrive at most important laws of heredity. In fact we study the origin of species, not as a curiosity, but as a practical problem, the solution of which must contribute eventually to human progress.

With these introductory remarks, the lecturer turned to the consideration of a few specific characters which are found in various species of pigeons.

The wing-bars found in domestic races and in the wild Rock Pigeons, were taken as an example to illustrate orthogenetic evolution by *gradual progressive modification*. It was shown first of all that the *two-barred* condition seen in the typical *Columba livia* is derived from the *checkered* condition seen in the wild *C. affinis*. It was then shown that this mode of derivation is wide-spread among wild species of pigeons, the bars always resulting from a reduction of the checkers, proceeding from before backward, the direction being the same as that of embryonic development.

Experiments with domestic pigeons demonstrate that it is easy to reduce the checkered type to four bars, then to three, two, one, and finally, to a uniform gray color without a single bar. Another set of experiments, to test the possibility of reversing the process, by advancing from the two-barred condition to the uniformly checkered type, showed that the direction could not be reversed.

It was next shown that among wild species of pigeons, we have the same law of orthogenesis illustrated over and over again, in almost endless variety of conditions. The Wild Passenger Pigeon, the Mourning Dove, the Zenaida, the Ground Dove of Florida, and a number of Old World species, were shown in colored drawings on charts.

After tracing wing-bars of the most diverse kinds to checkers, the origin of the latter from a still earlier and *universal avian character*, was explained. This earlier color-mark still persists in many pigeons, and other avian types, and is well preserved in the oriental Turtle Dove of Japan and China.

It consists of a single dark spot occupying the centre of the exposed part of each feather. In the course of evolution, this spot has been divided into two lateral spots by the disappearance of

pigment along the shaft, beginning at the apex of the feather and advancing gradually inward. The old Turtle-Dove character thus passes by a continuous process of division into the Rock Pigeon pattern, consisting of two checkers on each feather, more or less completely separated. The evidences showing such a gradual transmutation are still to be seen, and in such profusion as to wholly exclude doubt. Hundreds of species have been formed in this simple way, leaving no room for the claim of sudden, non-transitional mutations.

The *transitional* stages between the Turtle-dove pattern and the checkered pattern of the Rock pigeons, are exhibited not only as we pass from one species to another, but often as we advance from the juvenal to the adult plumage; and frequently they may be seen in different parts of one and the same individual plumage.

A still older character than the Turtle-dove spot is seen in the cross-bars, or *fundamental bars*, that appear to mark all feathers of all species of birds. These bars were first noticed in pigeons in the summer of 1903, and were soon found to be common to all species of pigeons and birds in general. From these fundamental feather-bars or their secondary derivatives, a multitude of specific characters have been evolved by gradual modification. The continuity in the evolution of some of these characters can be experimentally demonstrated. The little Diamond Dove (*Geopelia cuneata*) of Australia, owes its small white spots (two in each feather) to these bars. The transitional stages connecting the spots with the bars are not wholly given in passing from the juvenal to the adult plumage. But if we pluck a few of the juvenal feathers at suitable intervals, their places will be filled by new feathers of different ages, and in this way we may get the stages *intermediate between the bars of the young and the spots of the adult*. Thus we see that *the adult pattern, which normally appears to come in as a striking mutation, by a single jump, is only an end-stage in a continuous process of differentiation*. So it is everywhere. Suppression of stages in ontogeny looks like saltations; but whenever we can get at the *history of the character*, we find the continuity comes to light.

The characteristic secondary cross-bars of many races of the common fowl, pheasants, Guinea-fowl, ducks, woodpeckers, etc., have been moulded more or less directly out of, or upon these fun-

damental cross-bars,* which appear to underlie all avian color-marks even the "universal avian character" before mentioned, and its latest derivatives.

The passage from the juvenal to the adult plumage often presents us with two or more quite strongly contrasted color-patterns. The mutationist might see in this a striking illustration of discontinuity in the evolution of species.

In the normal course of events, the gap is often very wide between two successive patterns, but closer study and experiment teach us that, while the visible stages may seem entirely disconnected, they are in reality genetically bound together by a continuous differentiating process, or a system of processes. In most cases, perhaps in all, the apparent discontinuity in the phenomena means nothing more than a discontinuity in our knowledge.

Several other specific characters, usually regarded as "sports" or "mutations" were considered, and the continuity of their development from minute incipient stages are clearly established.

*The discovery of the universality of this character and its far-reaching significance as an initial foundation for numerous specific characters, suggested the need of a thorough investigation to determine its nature and mode of development. This task has been undertaken by Mr. Oscar Riddle, who has not only reached a physiological explanation of the character, but has fully confirmed and established the following anticipation I ventured to make in 1903:

"Allowing that the feathers of the common pigeon get their full length in four weeks, and that the terminal half of the feather (on which the bars are distinct enough to be counted) is formed in fourteen days, it is found that *the number of bars corresponds nearly to the number of days of growth*. If this be so, then the bars would be zones of daily growth (light = day; dark = night, or *vice versa*)."

WISCONSIN FLOWERS AND THEIR POLLINATION.

BY S. GRAENICHER.

MELANTHACEÆ, LILIACEÆ AND CONVALLARIACEÆ.

The plants dealt with in this paper belong to the order of Liliaceæ as defined by Gray in his Manual of Botany, but according to the classification adopted by Britton and Brown they have been distributed among the three families named above. The genera are treated in the same sequence as they appear in "Britton's Manual of the Flora of the Northern States and Canada," and the same nomenclature has been adopted.

Before considering the pollination of each species I shall outline in advance some of the results obtained.

An arrangement of the twenty-three species according to the order in which the flowers make their appearance furnishes the following list.*

1. *Trillium nivale*, March 26—April 27.
2. *Erythronium albidum*, April 20—May 15.
3. *Erythronium Americanum*, April 25—May 19.
4. *Uvularia grandiflora*, May 5—June 5.
5. *Trillium grandiflorum*, May 6—June 3.
6. *Vagnera stellata*, May 13—June 8.
7. *Trillium recurvatum*, May 15—June 1.
8. *Salomonias biflora*, May 17—June 10.
9. *Trillium erectum*, May 19—June 1.
10. *Asparagus officinalis*, May 20—October 1.
11. *Trillium cernuum*, May 22—May 27.
12. *Streptopus roseus*, May 23—June 7.

*In cases of insufficient observation the few dates on which the flowers were observed are given.

13. *Unifolium Canadense*, May 27—June 21.
14. *Vagnera racemosa*, June 2—June 29.
15. *Vagnera trifolia*, June 3 and June 5.
16. *Clintonia borealis*, June 3 and June 5.
17. *Salomonina commutata*, June 7—July 3.
18. *Tofieldia glutinosa*, June 15—July 18.
19. *Allium Canadense*, June 19—July 17.
20. *Lilium umbellatum*, June 20—July 16.
21. *Lilium Canadense*, July 2—July 28.
22. *Allium tricoccum*, July 11—August 15.
23. *Allium cernuum*, July 15—August 29.

In the early part of April the season of our entomophilous flora is ushered in by the appearance of the small-flowered and low-stemmed *Trillium nivale*, and from this time on there is a gradual increase in the number of the above named species in blossom until about May 27, when ten species have their flowers open together. After this maximum has been reached a gradual decrease in the number sets in until around the middle of July, when *Allium cernuum*, the latest of our native species, makes its appearance. The maximum just referred to corresponds with the maximum of the spring group of Andrenine bees (1) at the end of May and the beginning of June. By consulting the lists of visitors appearing further on in the account given of the pollination of the respective flowers we find that a number of the species representing the maximum of the spring group of those short-tongued bees appear as visitors of *Utricularia grandiflora*, *Vagnera stellata*, *V. racemosa* and *Streptopus roseus*, all of them in blossom at the beginning of June.

In the following table the flowers are placed in the classes of entomophilous flowers, as proposed by Hermann Mueller (2), and the number of insect visitors representing the different types is given.

1. S. Graenicher. The relations of the Andrenine bees to the entomophilous flora of Milwaukee County. Trans. Wis. Acad. Sc. A. and L. Vol. XV. Part I. pp. 92-93—(1905).

2. Herman Mueller. Alpenblumen, pp. 479-511.

	Bees.	Flies.	Butter- flies.	Other Insects	Total
<i>Pollen-flowers—</i>					
<i>Trillium nivale</i>					
" <i>erectum</i>	1				1
" <i>recurvatum</i>		1			1
<i>Vagnera racemosa</i>	8	11		9	28
<i>Unifolium Canadense</i>	2	5		2	9
<i>Flowers with exposed nectar—</i>					
<i>Vagnera stellata</i>	18	22	2	2	44
" <i>trifolia</i>				2	2
<i>Tofieldia glutinosa</i>	2	9	2	2	15
<i>Flowers with concealed nectar—</i>					
<i>Trillium grandiflorum</i>	2				2
" <i>cernuum</i>					
<i>Allium Canadense</i>	16	15		8	39
" <i>triccoccum</i>	9	3			12
" <i>cernuum</i>	12	1	1		14
<i>Bee-flowers—</i>					
<i>Erythronium albidum</i>	4				4
" <i>Americanum</i>	4				4
<i>Uvularia grandiflora</i>	9	1			10
<i>Salomonina biflora</i>	4				5 (1 bird)
" <i>commutata</i>	3				4 (1 bird)
<i>Asparagus officinalis</i>	8				8
<i>Streptopus roseus</i>	1				1
<i>Clintonia borealis</i>	4				4
<i>Butterfly-flowers—</i>					
<i>Lilium umbellatum</i>	1		3		4
" <i>Canadense</i>	2		1		3

POLLEN FLOWERS.

This class comprises the flowers which, on careful examination do not reveal a trace of nectar, and are therefore visited on account of their pollen only.

Three species of *Trillium* figure in this class while the two remaining ones of our flora are nectar-producing, and are referred to the flowers with concealed nectar. The flowers of all of these species are more or less showy, and well supplied with pollen, and still they are so rarely visited as to cause us great surprise. The

large-flowered and sweet-scented *T. grandiflorum* with a fair supply of nectar does not make an exception in this respect, not even in localities where the flowers appear in such number as to make them conspicuous to the human eye from a considerable distance. While discussing the variation in color of the flowers of *T. erectum* Robertson (3) expresses the opinion that the greenish variety is more or less degraded, and he states that "the flower seems to be losing its hold on insects and to form a transition between the other entomophilous species of *Trillium* and the still more degraded *T. sessile* and *recurvatum*." Judging from the observations made in our region as elsewhere it might appear as if our white species of *Trillium* were altogether either repulsive or at least poorly attractive to insects, possibly on account of some peculiarity of odor. At any rate they do not seem to depend to any extent on cross-pollination, and are all well prepared to insure spontaneous self-pollination.

In *Vagnera racemosa* and *Unifolium Canadense*, the two other species of pollen-flowers the absence of the higher bees (Apidæ) among the visitors is noticeable. Pollen-collecting short-tongued bees (Andrenidæ) and pollen-eating flies are the principal pollen-distributors, these insects furnishing about 68 per cent of the entire number of visitors of both flowers considered together.

FLOWERS WITH EXPOSED NECTAR.

We have here, as usually in flowers of a simple structure and with exposed nectar a rather varied gathering of insects with a strong preponderance of short-tongued bees and flies, 72 per cent. of the totality of the visitors of the three species belonging to these two groups of insects.

FLOWERS WITH CONCEALED NECTAR.

The two species of *Trillium* have been considered above together with the species of this genus among the pollen-flowers.

In our three species of *Allium* we are dealing with three flowers differing in structure, and accordingly attracting a somewhat different set of visitors. *A. Canadense* the earliest among them represents the lowest type in which the nectar is not deeply concealed,

3. Chas. Robertson. Flowers and insects. XVI. Bot. Gaz. XXI. p. 272 (1896).

while in *A. cernuum* we have at the same time the latest and the more specialized flower with the nectar hidden at the bottom of a narrow tube. *A. tricoccum* is intermediate between the other two. The percentage of bees for the three species is as follows:

<i>A. Canadense</i>	41%
<i>A. tricoccum</i>	75%
<i>A. cernuum</i>	86%

The reddish-purple color and the nodding position of the flowers of *A. cernuum* together with the presence of a tube leading down to the nectar all suggest an adaptation to bees, and correspondingly we have a high percentage of bees attending them. The tube is rather short and this species seems to be transitional between the flowers with concealed nectar and typical bee-flowers.

BEE-FLOWERS.

They are eight in number, all of them with pendulous flowers, and they show a great difference in color, greenish, white, yellow and rose being represented. A glance at the table shows to what extent these flowers receive the attention of bees, other visitors being nearly excluded. The large flowers of *Erythronium*, *Urtularia*, *Salomonina* and *Clintonia* are bumble-bee flowers, while *Asparagus officinalis* and *Streptopus roseus* may be regarded as adapted to the smaller bees.

The visits of our humming bird to the flowers of *Salomonina biflora* and *S. commutata* are noteworthy. Birds are known to be attracted especially by bright red colors, and in our region *Castilleja coccinea*, *Aquilegia Canadensis*, *Impatiens biflora* and *Lobelia cardinalis* are considered characteristic bird-flowers, but our humming bird (*Trochilus colubris* L.) also visits various flowers of other color than red, and its presence at the green flowers of *Salomonina* seems to indicate that in this respect a tubular or similar structure of a flower is of as much importance as the color.

BUTTERFLY-FLOWERS.

The lilies of our region are undoubtedly adapted to butterflies, and *Argynnis cybele* one of our most common butterflies seems to be the most frequent visitor of both of the species. In these flowers a great quantity of pollen is produced by the large anthers, and this explains the comparatively frequent visits of pollen-collecting bees of the genera *Augochlora* and *Halictus*.

FAM. MELANTHACEÆ.

Tofieldia glutinosa (Mich.) Pers. Glutinous *Tofieldia*.

We encounter this species forming patches in damp places on the clay-bluffs along Lake Michigan north of Whitefish Bay, and blooming from about June 15 to July 18. The inflorescence is a raceme of 3 to 4 cm. length at the end of a scape which is 3 to 4 dm. long, and which is covered nearly for its entire length with viscid glands. The white flowers with a diameter of 9 mm. are directed somewhat laterally. They are arranged in groups of three, and those at the top of the inflorescence are the first to open. The perianth-leaves do not spread entirely in the open flower, and the six stamens which are 4 mm. long occupy an intermediate position between the pistil and the perianth-leaves. The yellow anthers open introrsely one by one. They are slightly surpassed by the three short branches of the style which by bending outwards to some extent place their stigmatic surfaces in the way of insect visitors. These flowers are homogamous. A drop of nectar is secreted near the base of the ovary in each of the septal furrows, and when the amount increases it gathers between the ovary and the broadened base of the opposite filament. After fertilization has been accomplished the pedicel undertakes an inward movement and presses the ovary against the stem. Along with this movement a reddish-purple coloration of the upper parts of the ovary, branches of the style and tips of the persistent perianth-leaves sets in resulting in a color-contrast between the top of the inflorescence and its lower region where the flowers are still or hardly in bloom. The flowers are sufficiently visited by insects to insure either self or cross-pollination, and spontaneous self-pollination from the falling of pollen on the stigma is barely probable since the latter is usually not situated directly below an anther. A small-sized insect when sucking nectar is liable to bring one side of its head or thorax in contact with an anther, and the other side with a stigma, and a subsequent visit to another flower may result in cross-pollination. The following visitors were observed on the flowers:

A. Hymenoptera

Apidæ: (1) *Apis mellifera* L. worker, s.; Andrenidæ: (2) *Halictus zephyrus* Sm. female, s.; Vespidæ: (3) *Polistes pallipes* St. Farg., s.

B. Diptera

Bombyliidæ: (4) *Anthrax sinuosa* Wied.; Syrphidæ: (5) *Syrphus americanus* Wied.; (6) *Allograpta obliqua* Say; (7) *Mesogramma marginata* Say; Tachinidæ: (8) *Exorista nigripalpis* Town.; (9) *Archytas analis* Fabr.; Sarcophagidæ: (10) *Sarcophaga helcicis* Town.; Muscidæ: (11) *Lucilia sylvarum* Meig.; (12) *L. sericata* Meig.;—all s. or f. p.

C. Lepidoptera

Rhopalocera: (13) *Pontia rapæ* L.; (14) *Phyciodes tharos* Dru.—all s.

D. Coleoptera

Mordellidæ: (15) *Mordellistena comata* Lec. s.

This list is similar to that obtained by H. Mueller (4) for *Tofieldia calyculata* Wahlenberg in the Alps, viz: 1 bee, 6 flies, 3 beetles, 3 butterflies and 1 ant. As regards the latter insect it is interesting to note that in our species of *Tofieldia* the viscid glands along the stem do not prevent the ants from reaching the flowers, although such arrangements are generally supposed to protect the flowers from these and similar intruders. Two species of ants *Formica fusca* L. var. *subsericca* (Say) Emery and *Cremastogaster lineolata* (Say) Emery were seen crawling on the flowers, and feeding on nectar.

Uvularia grandiflora J. E. Smith. Large-flowered Bellwort.

The blooming period extends from May 5 to June 5. Robertson (5) has made us acquainted with the mode of pollination of this species in southern Illinois, and little is to be added from observations on flowers of our region. The one or two pendulous flowers have a length of 4 cm. In the newly opened ones the twisted perianth-leaves are close together and only bees of large size (bumble-bees) are able to force their way in, but later on especially in warm weather, the flower through the loosening of

4. Herm. Mueller. Alpenblumen pp. 39-40. See also P. Knuth. Handbuch der Blutenbiologie. Vol. II, p. 516.

5. Chas. Robertson. Flowers and insects. XVI. Bot. Gaz. Vol. XXI. pp. 270-271. (1896).

the perianth-leaves becomes more bell-shaped, and allows smaller bees to gain access to the pit-shaped nectaries, one of which is situated at the base of each of the perianth-leaves. As a rule the three branches of the style are about 5 mm. shorter than the six stamens with their anthers of 15 mm. length, and they bend outward between the latter so as to place their stigmas in the path of the insects that are pushing their mouth parts up towards the nectaries.

When emptying their pollen the anthers begin to open at the base, and the slit gradually progresses downwards (in the pendulous flower) and reaches the branches of the style. At this juncture spontaneous self-pollination can take place in the homogamous flower, but previous to this an insect may have effected cross-pollination. In exceptional cases the branches of the style are longer and surpass the anthers entirely, and spontaneous self-pollination is rendered less probable. The flowers are without any odor.

The principal pollinator in our region is the female bumble-bee *Bombus americanorum* Fabr., but the visits of the smaller bees, especially those of the genera *Osmia* and *Andrena* are undoubtedly also effective. Two specimens of a Syrphid-fly *Chilosia cyanescens* Loew differed in their behavior on the flowers. One of them inserted its proboscis from the outside between two perianth-leaves at their bases, and obtained nectar without rendering any services to the flower. This was done repeatedly. The other one was feeding on pollen while hanging on to the anthers, and probably coming in contact with the stigmas. In this manner different flowers were visited whereby self-or cross-pollination may have been the result. The list of visitors is as follows:

A. Hymenoptera

Apidæ: (1) *Bombus americanorum* Fabr. female, s. and c. p.; (2) *Osmia pumila* Cr. male and female, s.; Andrenidæ: (3) *Andrena cressonii* Rob. female, s. and c. p.; (4) *A. rufosignata* Ckli. female, s. and c. p.; (5) *Andrena* sp. female, s.; (6) *Halictus provancheri* D. T. female, s.; (7) *H. cressonii* Rob. female, s. and c. p.; (8) *H. versatus* Rob. female, s.; (9) *H. pilosus* Sm. female, s.

B. Diptera

Syrphidæ: (10) *Chilosia cyanescens* Loew, s. and f. p.

FAM. LILIACEÆ.

Allium tricoccum Ait. Wild Leek.

This plant is remarkable from the fact that the rather large leaves make their appearance quite early in the spring, but dry up and disappear before the blooming time sets in. The latter lasts from July 11 to August 15. There are about fourteen greenish-white inconspicuous flowers on short pedicels forming an umbel at the end of a scape of about 22 cm. in length. The perianth-leaves are only 4 to 5 mm. long, they remain in an erect position with their tips inclining towards the stamens, the light yellow anthers of which are just lifted above the perianth-leaves. From the middle of the 3-parted ovary arises the erect slender white style with its simple stigma. The flowers are proterandrous. At first the three anthers of the inner row shed their pollen, and at this time the style has reached only two-thirds of its length. Later on while the outer anthers are dehiscing the style becomes fullgrown and the receptive stigma is on the same level with the anthers. The first flower of an umbel is located centrally, the process of blooming therefore progresses from the center to the margin. Nectar is secreted by septal glands and appears as a drop in each of the furrows about half way up. It is concealed between the furrow and the broadened base of the corresponding filament and, besides, the erect position of the perianth-segments also assists in hiding it from view. No odor is emitted by these flowers.

Although in an older flower a receptive stigma may be present together with pollen on the outer anthers there is hardly a possibility of spontaneous self-pollination on account of the upright position of the flower and the distance between the stigma and the outer anthers.

Insects engaged in sucking nectar push their heads in between the stigma and the introrse anthers, and become dusted with pollen on the sides of their heads. Their visits to different flowers result in most instances in cross-pollination. Bees are the main visitors, as seen from the following list:

A. Hymenoptera

Apidæ: (1) *Apis mellifera* L. worker, s.; (2) *Bombus consimilis* Cr. worker, s.; (3) *Alcidamea producta* Cr. female, s.;

Andrenidæ: (4) *Halictus provancheri* D. T. female, s. and c. p.; (5) *H. connexus* Cr. female, s. and c. p.; (6) *H. zephyrus* Sm. female, s. and c. p.; (7) *H. pilosus* Sm. female, s.; (8) *Prosopis modesta* Say female, s.; (9) *P. affinis* Sm. female, s.

B. Diptera

Syrphidæ: (10) *Mesogramma geminata* Say; (11) *Sphaerophoria cylindrica* Say; Muscidæ: (12) *Lucilia cæsar* L.—all s. or f. p.

Allium Canadense L. Meadow Garlic.

The flowering period is from June 19 to July 17. There are 4 to 18 pinkish flowers arranged in a terminal umbel of 4 dm. length, and in addition to these the inflorescence contains about a dozen ovoid bulblets. The perianth-leaves are 7 mm. long, and they spread sufficiently to give the flower a diameter of 12 to 15 mm. In the middle of each of these pinkish leaves, especially on those of the inner row, a light violet line, the so-called nectar-guide, points towards the middle of the flower. Nectar appears near the base of the ovary in the septal furrows and accumulates between the latter and the bases of the inner filaments. The flowers have a faint sweet scent.

Proterandry is well marked. In the first or male stage the anthers dehisce one after the other, and the style has at the beginning of this stage a length of only $1\frac{1}{2}$ mm. with scarcely a trace of a stigma. The introrse anthers gradually become extrorse. In the second or female stage the style attains its entire length of 4 mm., and the stigma reaches maturity after all of the anthers are empty, rarely before. The stigma surpasses the anthers. The style assumes a pink color and the stamens also (with the exception of the light-yellow pollen) agree in color with the perianth.

Numerous insects pay their attention to the flowers, and cross-pollination is insured through the high degree of proterandry. Visitors were taken as follows:

A. Hymenoptera

Apidæ: (1) *Clisodon terminalis* Cr. female, c. p.; (2) *Alcidamca producta* Cr. female, s.; (3) *Andronicus cylindricus* Cr. male, s.; (4) *Osmia pumila* Cr. female, s.; (5) *Stelis 6-maculata* Ashm. female, s.; (6) *S. submarginata* Cr. female, s.; (8) *Coelioxys moesta* Cr. female, s.; (9) *Calliopsis andreniformis* Sm.

female, s. and c. p.; Andrenidæ: (10) *Halictus provancheri* D. T. male, s.; (11) *H. coriaceus* Sm. female, s. and c. p.; (12) *H. albipennis* Rob. male, s.; (13) *H. cressonii* Rob. female, s.; (14) *H. versatus* Rob. female, s.; (15) *Prosopis pygmaea* Cr. male, s.; (16) *P. modesta* Say female, s.; Crabronidæ: (17) *Oxybelus 4-notatus* Say, s.; Philanthidæ: (18) *Cerceris nigrescens* Sm., s.; Sphegidæ: (19) *Ammophila vulgaris* Cr., s.; Eumenidæ: (20) *Eumenes fraternus* Say; (21) *Odynerus pennsylvanicus* Sauss.; (22) *O. conformis* Sauss.—all s.

B. Diptera

Bombyliidæ: (23) *Bombylius atriceps* Lw.; Syrphidæ: (24) *Paragus tibialis* Fall.; (25) *Syrphus americanus* Wied.; (26) *Mesogramma marginata* Say; (27) *M. geminata* Say; (28) *Sphærophoria cylindrica* Say; Agromyzidæ: (29) *Ochthiphila polystigma* Meig.; Tachinidæ: (30) *Gymnosoma fuliginosa* Desv.; (31) *Senotainia trilineata* v. d. W.; (32) *Ocyptera dosiades* Walk.; (33) *Peleteria tessellata* Fabr.; Muscidæ: (34) *Lucilia sylvarum* Meig.; (35) *L. sericata* Meig.; Anthomyidæ: (36) *Phorbia fusciceps* Zett.; (37-38) *Phorbia* spp.—all s. or f. p.

C. Coleoptera

Coccinellidæ: (39) *Coccinella sanguinea* L., s.; Mordellidæ: (40) *Mordellistena comata* Lec. s.

Allium cernuum Roth. Nodding wild onion.

Foerste (6) has given an account of the pollination of this species in which he called attention to the proterandry of the flowers. Around Milwaukee this plant is in bloom from about July 15 to August 29. Through the bending of the scape of 3 to 4 dm. length just below the umbel the very numerous flowers become nodding. At the time of the opening of the first flowers along the margin of the inflorescence those in the middle are still far behind in their development. The reddish-purple perianth-segments contrast rather strongly with the yellow anthers that protrude from the mouth of the flower. While the three outer perianth-segments are directed outwards, each of the three inner ones is erect, and with its wing-shaped margins it encloses the

6. A. F. Foerste. Fertilization of the wild onion. Am. Nat. Vol. XIX. p. 601. (1885).

opposite filament of the inner row. Corresponding projections of the upper margin of the ovary surround these filaments from within, and in this manner tubes are formed leading down to the nectar between the base of these filaments and the ovary. There is a rich supply of nectar coming from the septal glands. The stamens with their pinkish filaments have, when fully developed, a length of 12 mm., one-half of which extends outside of the perianth. One by one they grow in length and empty their pollen, those of the inner row in advance of the others. In this respect the specimens of our surroundings do not agree with those studied by Foerste who states that the outer stamens are the first to dehisce. In the first stage of these proterandrous flowers when the three inner stamens have reached their entire length the stigmatic region of the style is situated in the mouth of the flower. By the time the outer stamens have shed their pollen the style has become as long as the anthers, and the stigma has reached maturity. This represents the second or female stage. Proterandry is so distinct in this species of *Allium*, as to render cross-pollination a certainty. The faintly sweet-scented flowers are rather attractive to bees as shown by the following list:

A. Hymenoptera

Apidae: (1) *Apis mellifera* L. worker, s.; (2) *Bombus pennsylvanicus* De G. female and worker, s.; (3) *B. virginicus* Oliv. worker, s.; (4) *B. ternarius* Say, female and worker, s.; (5) *Clisodon terminalis* Cr. female, s.; (6) *Anthophora walshii* Cr. female, s.; (7) *Megachile fragilis* Cr. female, s.; Andrenidae: (8) *Halictus forbesii* Rob. female, s. and c. p.; (9) *H. zephyrus* Sm. female, c. p.; (10) *H. albipennis* Rob. female, c. p.; (11) *H. sparsus* Rob. female, c. p.; (12) *Colletes eulophi* Rob. female, s.

B. Diptera

Syrphidae: (13) *Tropidia quadrata* Say, s.

C. Lepidoptera

Rhopalocera: (14) *Pontia rapæ* L., s.

***Lilium Canadense* L.** Wild yellow Lily.

The blooming time is from July 2 to 28. On the outside the nodding flowers are red with a yellowish tinge while the inner surface is mainly yellow with numerous small brown spots. Shortly

after opening the perianth-segments spread horizontally so as to give the flower a diameter of 10 to 11 cm., but later the tips of the segments become reflexed. At the base the segments are closely approximated for a length of about 3 cm., and form a bell-shaped portion of 5 mm. diameter at the bottom. This space is nearly entirely occupied by the ovary and the filaments, and consequently only long-tongued insects can gain access to the nectar which is secreted in a depression at the base of each segment. No odor is perceptible. The extrorse anthers are 12 mm. long, they produce a great amount of reddish-brown pollen, and are lightly attached to the long (4 cm.) filaments. On account of the bending of the upper part of the filaments the anthers are carried outwardly, and finally they form a circle of 2 to 3 cm. diameter around the capitate dark brown stigma, which is situated on the same level. On the second day the upper part of the style curves outwards and brings the stigma either in contact with one of the anthers or in a position between two of them. In this new position the stigma is more apt to be struck by large insects approaching the flower from the side, butterflies or hawk-moths for example.

According to Meehan (7) this lily is self-sterile. The dusting of the stigma with pollen from the same plant (self-pollination) would therefore be of no use to the plant. This mode of pollination, although ineffective is undoubtedly of common occurrence in these homogamous or slightly proterandrous flowers, and once on a windy day, soon after the opening of a flower I saw a swaying anther touch the stigma before any insects had made their appearance.

A small bee, *Halictus versatus* Rob., while collecting pollen was observed crawling around on the anthers as well as on the stigma, and a repetition of this behavior in a second flower might lead to cross-fertilization. Lovell (8) saw a bumble-bee, *Bombus vagans* Sm., alight on the stigma and afterwards crawl up along the anthers. He expresses the opinion that this species is visited by bees only, but it is probably adapted to Lepidoptera the

7. Thomas Meehan. Observations on Lilies. Proc. Acad. Nat. Sc. Phil. 1875. pp. 412-413.

8. J. Lovell. The color of northern monocotyledonous flowers. Am. Nat., Vol. XXXIII., p. 498 (1899).

same as the average species of *Lilium*, and I have witnessed the visits of a butterfly, *Argynnis cybele* Fabr., to the flowers. I have often been on the lookout for visitors, but have seen the following only:

A. Hymenoptera

Andrenidæ: (1) *Halictus forbesii* Rob., female, c. p.; (2) *H. versatus* Rob. female, c. p.

B. Lepidoptera

Rhopalocera: (3) *Argynnis cybele* Fabr., s.

Lilium umbellatum Pursh. Western red Lily.

This lily occurs on the clay-bluffs along Lake Michigan together with *Tofieldia glutinosa*, the species considered previously and its flowering period from June 20 to July 16 falls together with that of *Tofieldia*. In the specimens under observation each plant carried either one or two of the erect flowers measuring about 12 cm. across. The perianth-segments are directed laterally, and there is a slight recurving of the tips. Each of them becomes narrowed in the basal region, forming a so-called claw, the margins of which are turned inward so as to meet each other and form a tube 2 cm. in length leading to the nectary at the base of the claw. There is a scanty supply of nectar, and no odor. The perianth-segments are red, changing to orange mixed with dark-brown spots around the opening of the tube. The stamens reach a length of 7 cm., and in consequence of an outward movement the anthers form a circle of 2 cm. diameter around the stigma, the same as in *Lilium Canadense*. Anthers and stigma are on the same level, and in the older flower the latter is carried to one side and often brought in touch with an anther. This leads to spontaneous self-pollination. Whether this species is also self-sterile like the preceding one I am unable to state. In these homogamous flowers the filaments and style agree in color with the perianth-leaves, but the anthers and stigma are dark-brown and the pollen brownish-yellow.

In favorable weather pollination is mostly due to the visits of butterflies, but pollen-collecting bees may also touch the stigma if they appear very shortly after the opening of the flower before the anthers have moved away from the stigma. The butterfly *Argynnis cybele* Fabr. is the most frequent visitor. It settles down

on one side of the flower and crawls around between the stamens and the perianth-leaves, draining one nectary after the other, and thereby dusting the lower surface of its front wings with pollen. Incidentally it rubs these same parts against the stigma. One bee and three butterflies make up the list of visitors:

A. Hymenoptera

Andrenidæ: (1) *Augochlora confusa* Rob. female, c. p.

B. Lepidoptera

Rhopalocera: (2) *Papilio polyxenes* Fabr.; (3) *Argynnis cybele* Fabr.; (4) *Phyciodes tharos* Dru.—all s.

Erythronium albidum Nutt. White Adder's Tongue. White Dog's tooth Violet.

This plant has been found in bloom from April 20 to May 15. Robertson (9) has given an account of this species and from this we see that there is a considerable difference in size between the flowers of our region with a diameter of 3 to 4 cm., and those of southern Illinois with a diameter of 6½ cm. There is a solitary nodding white flower at the end of a scape of about 12 cm. length. Each of the three inner perianth-leaves has a pit-shaped nectary near the base and a small furrow running down to the latter. The adjoining filament covers the furrow from within, and the proboscis of an insect has to pass through the canal thus formed in order to obtain nectar. There is a median yellow spot, a "nectar-guide" near the base of each of the perianth-leaves, and it is of a deeper color and more distinctly heart-shaped on the inner ones. The stamens of the outer row are shorter than the others on account of the shorter anthers, and they shed their pollen entirely before those of the inner row start to dehisce. The flowers are homogamous since the stigma matures together with the outer anthers. As a rule the stigma in this species has three long and spreading branches, while that of *E. Americanum* the second species of our flora is usually short and simple. But Meads (10) has shown that there exists a great amount of vari-

9. Chas. Robertson. Flowers and insects VIII. Bot. Gaz., Vol. XVII., pp. 69-71 (1892).

10. M. E. Meads. The range of variation in species of *Erythronium*. Bot. Gaz., Vol. XVIII., p. 134 (1893).

ation in the two species, and that *E. albidum* may produce a stigma of the type credited to *E. Americanum*, and vice versa. The inner anthers surpass the stigma to a slight extent only.

According to Robertson cross-pollination may take place at any time, but he considers spontaneous self-pollination of common occurrence in absence of insects. The closing of the flowers at night and in rainy weather would seem to me to favor spontaneous self-pollination as thereby the anthers of the inner row are pressed against the stigma. The same mode of pollination may also result from the falling of pollen in a flower in which the stigma is situated directly below an anther. As Robertson points out the nodding position of the flowers favors the visits of bees, and nearly excludes other insects, and sixteen of the twenty-two visitors observed by him were bees. In our region the flowers are not so extensively visited, and I have noted the following bees only:

Hymenoptera

Apidæ: (1) *Ceratina dupla* Say, male and female, s.; (2) *Osmia pumila* Cr. male, s.; Andrenidæ: (3) *Andrena vicina* Sm. female, s. and c. p.; (4) *Augochlora confusa* Rob., female, s.

Erythronium Americanum Ker. Yellow Adder's Tongue.

The first flowers appear several days behind those of the foregoing species, and the blooming time extends from about April 25 to May 19. When open the nodding flower is conspicuously yellow and is situated about 16 cm. above the ground. The bud has a reddish-brown color, due to such a coloration of the outer surface of the outer perianth-leaves. The inner surface of the latter and the leaves of the inner row in their entirety are yellow except towards the base where they become brownish with numerous minute reddish-brown spots. In this species too, as in the preceding one the nectaries are situated at the base of the inner perianth-leaves, and a furrow guides the insect's tongue down to each of them. Dehiscence begins in the anthers of the outer row, the stamens of which are shorter than those of the inner row. The latter are 25 mm. long or about 2 mm. longer than the pistil. While considering the preceding species it was stated that the stigma in *E. Americanum* usually does not spread out in branches as in *E. albidum*. It is therefore not as liable to catch falling pollen in the open flower or to meet the anthers in the

closing flower as that of the last named species, and consequently spontaneous self-pollination might not be favored to such an extent in *E. Americanum* as in *E. albidum*.

As regards pollination through the activity of insects the conditions are about the same in both species. Bees are here also the principal visitors.

Besides perfect (hermaphrodite) flowers Meads (11) has come across female flowers i. e., with rudimentary anthers, not producing any pollen. This species therefore furnishes an example of a gynodioecious plant.

The following species of bees are the only visitors I have noted on the flowers.

Hymenoptera

Apidæ: (1) *Bombus americanorum* Fabr. female, s.; (2) *Osmia pumila* Cr. male, s.; Andrenidæ: (3) *Andrena vicina* Sm. female, c. p.; (4) *Halictus 4-maculatus* Rob. female, c. p.

FAM. CONVALLARIACEÆ.

Asparagus officinalis L. *Asparagus*.

The asparagus has escaped from cultivation and is a comparatively common wild plant around Milwaukee, blooming from about May 29 throughout the summer. Belated flowers have been seen even on October 6. Mueller (12) described and figured the greenish, pendulous and bell-shaped flowers. Breitenbach (13) noted the occurrence of perfect (hermaphrodite) flowers, but as a rule each plant has either male or female flowers only. Among the numerous specimens examined in our surroundings I have never come across one with perfect flowers. The male flower has a length of 6 mm., and always contains a rudimentary pistil. The female flower is considerably shorter (3 to 4 mm.) and is supplied with abortive anthers.

11. M. E. Meads. Loc. cit., p. 137.

12. H. Mueller. Befruchtung der Blumen durch Insekten, pp. 64-65. See also P. Knuth Handb. d. Blütenbiologie, Vol. II., pp. 505-506.

13. W. Breitenbach. Ueber *Asparagus officinalis*, etc. Bot. Ztg., Vol. XXXVI., pp. 163-167.

The flowers with their faint odor are regularly visited by bees, but the larger and therefore more conspicuous male flowers are decidedly more attractive than the female flowers. On June 19 two large plants standing close together, one with male and the other with female flowers, were kept under observation for some length of time. The male flowers received a grater number of visitors, mostly female bees of the genus *Halictus* in search of pollen, and the few bees paying their attention to the female flowers were mostly supplied with pollen from their previous visits to the male flowers. In this manner cross-pollination is insured in accordance with the rule laid down by Sprengel that in diclinous plants the male flowers are more showy so as to attract the insects in the order most favorable to pollination. Both kinds of flowers secrete nectar at the bottom of the tube.

The following visitors were observed on three different days in June:

Hymenoptera

Apidæ: (1) *Bombus consimilis* Cr. female, s.; (2) *Ceratina dupla* Say female, s. and c. p.; (3) *Megachile infragilis* Cr. male, s.; Andrenidæ: (4) *Augochlora confusa* Rob. female, s. and c. p.; (5) *Halictus coriaceus* Sm. female, c. p.; (6) *H. 4-maculatus* Rob. female, c. p.; (7) *H. zephyrus* Sm. female, c. p.; (8) *Prosopis pygmæa* Cr. female, s.

Clintonia borealis (Ait) Raf. Yellow Clintonia.

On two different occasions, on June 3 and 5, I have had the opportunity of watching these flowers in a tamarack swamp at Elkhart Lake, Sheboygan Co., Wis. They were visited by two species of bumble-bees and two smaller bees as follows:

Hymenoptera

Apidæ: (1) *Bombus consimilis* Cr. female, s. and c. p.; (2) *B. virginicus* Oliv. female, s. and c. p.; Andrenidæ: (3) *Halictus versatus* Rob. female, c. p.; (4) *Agapostemon radiatus* Say female, s.

Miss Alice Carter (14) witnessed the visits of bumble-bees at Ithaca, N. Y., and Lovell (15) in Maine those of a beetle, the

14. Alice Carter. Notes on pollination. Bot. Gaz., Vol. XVII., p. 21 (1892).

15. J. Lovell. Loc. cit., p. 499.

honey-bee and a bumble-bee *Bombus consimilis*, one of the species represented in the list given above.

The bell-shaped greenish-yellow flowers are situated at the summit of a scape forming an umbel of three to six pendulous flowers directed to one side, and in addition to these we sometimes find two or three flowers lower down on the same side of the scape. The six perianth-leaves are recurved so as to give the fully developed flower a diameter of $2\frac{1}{2}$ cm. Stamens, pistil and perianth-segments are all of the same length, from 18 to 20 mm. In the basal region the segment is folded together and forms a medial furrow of 2 mm. depth along the inner side, at the bottom of which nectar is secreted. The broadened base of the opposite filament covers the furrow and a canal of 6 mm. length is thereby constructed running down to the nectary.

The style protrudes from the middle of the flower, but it is directed slightly downward and carries a broad flattened stigma. The anthers are about 5 mm. in length. They are kept well out of the way of the stigma, being arranged in a circle of 2 cm. diameter around the latter. Such an anther splits open laterally and within a short time along its entire length. In warm and dry weather this whole process of dehiscence may be accomplished within an hour. The flowers are homogamous.

There is a slight possibility of spontaneous self-pollination taking place through the falling of pollen on the stigma, but the flowers are adapted to long-tongued bees and bumble-bees (flying at this time of the year in the female sex only) are certainly the most efficient pollinators. Such a bumble-bee usually alights on the lowest flower of a group and after sucking and collecting pollen crawls up to the neighboring one. Cross-pollination or at least self-pollination is the outcome. The visits of the short-tongued bees mentioned in the list, (*Halictus* and *Agapostemon*), are hardly of any use to the flowers, unless they alight on the stigma, but this is generally not the case.

An interesting feature of these flowers is the arrangement by which they are more or less protected from unwelcome visitors. The bases of the filaments are well supplied with protruding hairs, and the same is the case with the perianth-divisions in their basal region along the outer surface, where they are close together. This renders it difficult for ants and all kinds of short-tongued insects to push their mouth parts from the outside in between the peri-

anth-divisions at the base of the flower or in between the base of a filament and a perianth-division on the inside.

***Vagnera racemosa* (L.) Morong. Wild Spikenard.**

Robertson (16) has described the structure of these flowers, and given an account of their pollination as observed by him in Macoupin Co. in southern Illinois, where the flowers bloom from May 7 to 30. In our latitude they appear nearly a month later, extending their flowering period from about June 2 to 29. The white flowers are very small, and are gathered in a panicle at the end of the stem, but being very numerous they render the inflorescence visible from a considerable distance. I estimated the number of flowers in an inflorescence of 5 cm. breadth and 14 cm. length at about 500. The main parts of the flower are the divergent stamens and the pistil, while the perianth-segments are exceptionally small and inconspicuous as pointed out by Robertson. The flowers are proterogynous and cross-pollination is the probable outcome. Grassmann (17) noted the presence of septal glands, but Robertson could not detect any nectar, and in our surroundings these flowers do not show the slightest trace of nectar. They are visited for pollen only, but their peculiar odor may be quite attractive to certain insects, bugs for example that I have repeatedly seen gathering in numbers on the flowers towards evening.

In southern Illinois this species seems to be poorly visited, only three small bees and one beetle having been noticed by Robertson. In a certain locality along the railroad north of West Allis, a suburb of Milwaukee, the plants are plentiful, and I observed quite a gathering of various insects, notably bees and flies, but also beetles and bugs. Following is the list of these visitors:

A. Hymenoptera

Andrenidæ: (1) *Andrena nivalis* Sm. female, c. p.; (2) *A. corni* Rob. female, c. p.; (3) *A. cressonii* Rob. female, c. p.; (4) *Augochlora confusa* Rob. female, c. p.; (5) *Halictus lerouxii*

16. Chas. Robertson. Flowers and insects XVI. Bot. Gaz., Vol. XXI., p. 270 (1896).

17. P. Grassmann. Die Septaldruesen, Flora. Vol. LXVII., p. 118 (1884).

Lep. female, c. p.; (6) *H. zephyrus* Sm. female, c. p.; (7) *H. albipennis* Rob. female, c. p.; (8) *Sphecodes clematidis* Rob. female, searching for nectar.

B. Diptera

Stratiomyidæ: (9) *Stratiomyia lativentris* Lw.; Bombyliidæ: (10) *Bombylius atriceps* Lw.; Syrphidæ: (11) *Mesogramma geminata* Say; Tachinidæ: (12) *Peleteria tessellata* Fabr.; (13) *Archytas analis* Fabr.; Sarcophagidæ: (14) *Sarcophaga* sp.; Dexiidæ: (15) *Myocera cremides* Walk.; Muscidæ: (16) *Lucilia sylvarum* Meig.; (17) *L. sericata* Meig.; Anthomyidæ: (18) *Phorbia* sp.; (19) *Drymeia* sp.—all except (10) f. p., (10) probing around the base of the ovary for nectar.

D. Coleoptera

Elateridæ: (20) *Agriotes oblongicollis* Mels.; Scarabæidæ: (21) *Trichius piger* Fabr.; Cerambycidæ: (22) *Cyrtophorus verrucosus* Oliv.; (23) *Acmæops bivittata* Say; Anthicidæ: (24) *Corphyra collaris* Say; Meloidæ: (25) *Macrobasis unicolor* Kirby—all f. p.

D. Hemiptera.

Capsidæ: (26) *Calocoris rapidus* Say; (27) *Poecilocapsus lineatus* Fabr. (28) *P. goniphorus* Say—all resting on the flowers.

Vagnera stellata (L.) Morong. Star-flowered Solomon's Seal.

This common species blooms around Milwaukee from about May 13 to June 8 and the flowers are abundantly visited by bees as well as flies. Robertson (18) speaks of an adaptation to the less specialized bees—*Andrenidæ*, but my observations show that they are equally well adapted to the specialized flies of the family *Syrphidæ*, over one-half of the visitors belonging to the *Andrenidæ* and *Syrphidæ*, taken together. This is what might be expected when we consider the structure of the flowers. They are pure white with the exception of the light yellow anthers and are arranged in a terminal raceme. The diameter of a flower is about 12 mm. The leaves of the perianth are spread so as to form nearly a right angle with the axis of the flower, and the stamens take up an intermediate position between the perianth-segments and the pistil, whereby the anthers are kept at a distance from the

18. Chas. Robertson. Loc. cit., pp. 269-270.

stigma. The latter is receptive from the opening of the flower on, and later the introrse anthers open one by one. Proterogyny is well marked, and the flowers are destined to become cross-pollinated. Where the flowers grow in patches as they usually do, visitors are not lacking, and they are attracted by a liberal supply of pollen, an agreeable sweet odor, and easily accessible drops of nectar secreted at the base of the ovary.

I have taken the following insects on the flowers:

A. Hymenoptera

Apidae: (1) *Apis mellifera* L. worker, s.; (2) *Bombus consimilis* Cr. female, s.; (3) *B. ternarius* Say female, s.; (4) *Nomada cuneata* Rob. female, s.; (5) *N. cressonii* Rob. male, s.; (6) *Osmia purpurea* Cr. female, s.; Andrenidae: (7) *Andrena nivalis* Sm. female, s.; (8) *A. hartfordensis* Ckll. female, s.; (9) *A. cressonii* Rob., s.; (10) *A. sigmundi* Ckll., female, s.; (11) *Augochlora viridula* Sm., (12) *A. confusa* Rob., female, s. and c. p.; (13) *Agapostemon radiatus* Say, female, s. and c. p.; (14) *Halictus prozancheri* D. T., female, s. and c. p.; (15) *H. lerouxii* Lep., female, s. and c. p.; (16) *H. zephyrus* Sm. female, s. and c. p.; (17) *H. cressonii* Rob. female, s.; (18) *H. sparsus* Rob., female, s.; Eumenidae: (19) *Odynerus pennsylvanicus* Sauss., s.

B. Diptera

Stratiomyidae: (20) *Odontomyia pubescens* Day; Syrphidae: (21) *Mesogramma marginata* Say; (22) *M. geminata* Say; (23) *Sphaerophoria cylindrica* Say; (24) *Neoascia globosa* Walk.; (25) *Eristalis dimidiatus* Wied.; (26) *Helophilus similis* Macq.; (27) *H. laetus* Lw.; (28) *H. chrysostomus* Wied.; (29) *Mallota cimbiciformis* Fall.; (30) *Tropidia quadrata* Say.; (31) *Xylota cjuncida* Say; (32) *Syritta pipiens* L.; Tachinidae: (33) *Cistogaster immaculata* Macq.; (34) *Siphona geniculata* Deg.; (35) *Melanophrys insolita* Walk.; (36) *Gonia capitata* De G.; (37) *Peleteria robusta* Wied.; (38) *Archytas analis* Fabr.; Sarcophagidae: (39) *Sarcophaga* sp.; Muscidae: (40) *Lucilia sylvarum* Meig.; Anthomyidae: (41) *Hydrotæa* sp.—all s. or f. p.

C. Lepidoptera

Rhopalocera: (42) *Pontia rapæ* L.; s.; (43) *Atrytone zabulon* Bd. and Lec.—all s.

D Coleoptera

Scarabæidæ: (44) *Trichius piger* Fabr. s. and f. p.

Vagnera trifolia (L.) Morong. Three-leaved Solomon's Seal.

It is a common inhabitant of the same tamarack swamp at Elkhart Lake, Sheboygan Co., Wis., referred to above in connection with *Clintonia borealis*, and it was observed on the same dates as the latter, viz: June 3 and 5. The average height of the plants is 15 cm., and the ten to fourteen flowers on slender pedicels are arranged in a loose raceme. As regards the structure of the flower and the relative position of perianth-segments, stamens and pistil to each other there is a striking similarity to the flower of *V. stellata* considered above, but that of *V. trifolia* is much smaller, measuring only 6 to 7 mm. across. All of the parts of the flower are white, except the anthers which are brown-violet. Nectar appears in droplets in the furrows along the ovary and this indicates the presence of septal glands. In view of the more or less upright position of the flowers spontaneous self-pollination can hardly occur. Such a flower is proterogynous, but only for a short while, and consequently cross-pollination results from the early visits of insects while later on after the anthers have begun to empty their pollen either cross or self-pollination may be effected by such visitors. Altogether these flowers do not seem to attract insects to any extent. They are sweet-scented, but the individual flower is inconspicuous and the same may be said of the few-flowered loose inflorescence as a whole. On the two dates mentioned above two beetles were the only insects seen on the flowers, but the time available for such observations was too short, and we might expect to find small bees and flies paying attention to them. The two beetles belonged to the following species:

Coleoptera

Elateridæ: (1) *Cardiophorus convexulus* Lec.; (2) *Elater rubricus* Say—both s.

Unifolium Canadense (Desf.) Greene. Two-leaved Solomon's Seal.

Flowering period from May 27 to June 21. There may be as many as 50 of the small white fragrant flowers forming a terminal raceme on a stem 10 to 18 cm. high. The flowers are borne by short (4 mm.) pedicels two of which originate from a common point of the stem. A short time after the opening of the flower

the four perianth-leaves of 3 mm. length become strongly reflexed, and the four stamens which are only 2 mm. long move outwards. The two divisions of the pistil are connected nearly for their entire length, but the stigma is two-parted. The latter is already receptive at the time the flowers open, and the introrse anthers begin to dehisce shortly afterward. Proterogyny is therefore short-lived. On account of the vertical position of the flowers pollen is more liable to fall on the stigma of the same flower and produce spontaneous self-pollination than in any of the species of *Vagnera* dealt with above. No nectar is present, but the flowers receive sufficient attention from short-tongued bees and flies to effect cross-pollination in many instances. In the following I present the list of visitors observed on the flowers:

A. Hymenoptera

Andrenidæ: (1) *Halictus provancheri* D. T., female, c. p.; (2) *H. leonxii* Lep., female, c. p.

B. Diptera

Culicidæ: (3) *Culex stimulans* Walk.; Syrphidæ: (4) *Mesogramma geminata* Say; (5) *Neoascia globosa* Walk.; (6) *Mallota posticata* Fabr.; Conopidæ: (7) *Zodion fulvifrons* Say—all except (3) and (7) f. p.

C. Coleoptera,

Cerambycidæ: (8) *Cyrtophorus verrucosus* Oliv.; Chrysomelidæ: (9) *Crepidodera cucumeris* Harr.—both f. p.

^ **Streptopus roseus** Mich. Sessile-leaved Twisted-stalk.

This species has a rather short blooming time, viz: from about May 23 to June 7. None of the specimens under observation were higher than 4 dm., and while the smaller plants have simple stems the larger ones carry one or two branches in addition to the main stem. The slender pedicel of 1½ cm. length is bent downward under the corresponding stem-leaf, and carries a rose-colored pendulous and bell-shaped flower. The position of the latter under the nearly horizontal stem-leaf hides it from view from above, and also affords it some protection from the rain and the rays of the sun. There is an overlapping of the three perianth-leaves of the outer row and those of the inner row, whereby a tube is formed 8 mm. in length with reflexed tips. Each leaf of

the inner row has a furrow directed downwards to the nectary at the base, and such a cup-shaped nectary is also present at the base of each of the outer leaves, but without a furrow. The broadened filaments are closely appressed to their corresponding perianth-leaves, and for this reason the nectar of the three inner leaves can be reached only through a narrow tube 3 mm. in length. The six anthers in two rows are inclined towards the style, and dehiscence starts in those of the outer row. The three branches of the style surpass the anthers by at least 2 mm., and their stigmas are visible in the mouth of the flowers. This species seems to be slightly proterandrous since the papillæ of the stigma do not become plainly developed until the pollen is being shed. There is a sweet odor and an abundant supply of nectar. In the older flowers a change of color to a more intense and darker red takes place.

We have here an interesting example of an andromonoecious plant. In addition to the perfect (fertile) flowers just described there appear regularly somewhat smaller male flowers with normally developed stamens and undeveloped pistils, but furnishing a full amount of nectar. About one-half of the flowers are male (sterile), and these are always situated along the apical portion of the stem, while the perfect flowers are below. For example in a large plant with three branches the distribution of flowers was as follows:

Lower branch	3	perfect	2	male
Middle	"	2	"	3 "
Upper	"	5	"	2 "

In this specimen with seventeen flowers ten were perfect and only seven male, but in some instances fully one-half are male.

The only visitors seen on several occasions belonged to the same species of bee: *Andrena milwaukeeensis* Graen, female. This bee is in the habit of collecting pollen on various flowers and is therefore not an oligotropic visitor of *Streptopus roseus*.

Salomonium biflora (Walt.) Britton. Hairy Solomon's Seal.

The plants vary in height from about 5 to 8 dm., and are in blossom from May 17 to June 10. There are usually two, sometimes three of the greenish-white tubular flowers hanging from the same pedicel. The length of the perianth is 10 to 12 mm., and in width the tube varies from 4 mm. in the region of the ovary to 3 mm. in the middle, and still less at the mouth. The

six stamens are inserted above the middle of the tube. Their introrse anthers are directed inwardly and brought with their tips so close together as to form a cone in the mouth of the flower. An insect's probocis has free access to the flower through the six lateral spaces between the filaments and the tubes. On account of the length of the style (9 mm.) the capitate stigma with its numerous papillæ protrudes into the cavity of the hollow cone formed by the anthers. As soon as the line of dehiscence which begins at the apex of the anther reaches the stigma spontaneous self-pollination may take place. Before dehiscence has progressed so far an insect may effect self or cross-pollination by introducing its probocis through the middle of the flower and touching the stigma with pollen of the same or of another plant.

The species of *Salomonina* (*Polygonatum*) which have been examined so far are known to have homogamous flowers (19), but in *S. biflora* we are undoubtedly dealing with proterandry. While the stigma is receptive before the flower opens the anthers do not begin to dehisce until after the opening has taken place. This species differs in another respect from the species studied heretofore. In the latter nectar is secreted by the septal glands of the ovary, but in *S. biflora* it is produced in three spots on the inner surface of the perianth somewhat above the base. These three drops of nectar are visible from the outside through the transparent tube of the perianth, and they are situated on the distinct lines that indicate the middle of the three inner perianth-segments.

The opening of the flower takes place through the outward movement of the six tips (teeth) of the perianth-divisions, whereby those representing the inner row assume an erect position, while those of the outer row become reflexed. In the older (fertilized) flower these teeth move back to their original position and close the tube. The perianth gradually becomes yellow and withers.

The following visitors have been noticed on the flowers:

A. Hymenoptera

Apidæ: (1) *Apis mellifera* L. worker, s.; (2) *Bombus consimilis* Cr. female, s. and c. p.; (3) *B. virginicus* Oliv., female, s.; (4) *B. americanorum* Fabr., female, s.

B. Aves.(5) *Trochilus colubris* L., s.

Bumble-bees are the most important visitors. The visits of our humming-bird (*Trochilus colubris*) are of interest and have been discussed at the beginning of this paper.

***Salomonía commutata* (R. & S.) Britton.** Smooth Solomon's Seal.

This plant, the *Polygonatum giganteum* Dietr., is much larger than the one just referred to, reaching in our region a height of 10 to 15 dm. Its flowers appear later than those of the other species, from June 7 to July 3. Robertson (20) has considered this species in connection with a review of the genus. The specimens studied in our locality differ in several points from those of southern Illinois as described by Robertson. There are two to five flowers in a group. The tube is about 17 mm. long, and has a diameter of 4 mm. at the mouth and 6 mm. in the middle. The teeth of the outer perianth-divisions are hardly more reflexed than those of the inner, they are all nearly erect. The flowers are homogamous, stigma and anthers becoming mature as soon as the tube opens. In the Illinois plants (Robertson) the style is too short to touch the anthers, thereby excluding spontaneous self-pollination. In our specimens the style with its stigma either reaches up between the anthers as in *S. biflora*, or it even surpasses the anthers by at least 1 mm. In the latter case cross-pollination through insects may be more easily accomplished than in *S. biflora*, on the other hand spontaneous self-pollination may take place when the pollen falls. In the plants of our surroundings therefore two different ways are open to spontaneous self-pollination.

Nectar is produced by the septal glands of the ovaries, but in addition to this the tissues of the inner surface of the tube are very juicy and yield droplets of a sweet liquid when punctured by the mouth parts of the visiting insects. Even the inner surfaces of the teeth (tips of the perianth-division) which are dry immediately after the opening of the tube show such droplets after having received the attention of bees, and I have several times seen the short-tongued bees figuring in the list below (*Halictus*) obtaining sweets around the mouth of the flower.

In our region *Salomonía commutata* is andromonoecious. I

20. Chas. Robertson. Loc. cit., p. 268.

have come across specimens having the uppermost flower or the two uppermost flowers of the stem sterile i. e. with the style rudimentary or nearly wanting. This is the only example of an andro monoecious species of *Salomonina* (*Polygonatum*) hitherto reported.

The humming-bird has been observed at the flowers, and three bees besides:

A. Hymenoptera

Apidæ: (1) *Bombus consimilis* Cr., female, s.; Andrenidæ: (2) *Halictus forbesii* Rob., female, s.; (3) *H. 4-maculatus* Rob., female, s. and c. p.

B. Aves.

(4) *Trochilus colubris* L., s.

Trillium grandiflorum (Michx.) Salisb. Large-flowered Wake-robin.

It is the commonest of our species of *Trillium* and is usually found in blossom from about May 6 to June 3. The large erect white flowers are among the most conspicuous of the spring flowers of our woodlands. They are proterandrous as shown by Loew (21), who studied them from plants growing in the Botanical Garden at Berlin. The anthers are 12 mm. long, two-thirds of this length being above the stigmas and one-third reaching down below the latter. Dehiscence begins above, and as soon as the stigma is reached spontaneous self-pollination undoubtedly takes place unless it has been preceded by self or cross-pollination through insects. In flowers in which the anthers have shed their pollen completely the stigmatic surfaces may be seen surrounded by pollen. According to Miss Alice Carter (22) nectar is secreted by septal glands, and in the plants examined in our neighborhood this is very clearly the case. Large drops are sometimes visible between the septal furrows of the ovary and the petals, taking up the space around the bases of the filaments. We might expect these showy and sweet-scented flowers with an abundant supply of pollen and nectar to be decidedly attractive to insects, and still this is not the case. It is, on the contrary, quite astonishing how little attention is paid to them. The only insect ever seen by me

21. E. Loew. *Bluetenbiologische Beitræge* II. Pringsh. Jahrb. Vol. XXIII., pp. 78-79 (1892).

22. Alice Carter. Notes on pollination. Bot. Gaz., Vol. XVII., p 21 (1892).

visiting such a flower in search of food was a small bee, a male *Ceratina dupla* Say. Some bees, especially the males of solitary bees are in the habit of selecting flowers of convenient structure as lodging-places for the night or in inclement weather, and under these circumstances they may be instrumental in effecting pollination. On a very windy day I found a male of the same bee referred to above seeking protection in one of the flowers, and on another occasion I saw two males of *Andrena geranii* Rob., taking up their abode in such a flower, also on account of the very high wind. Miss Carter kept flowers of this species under observation at the Botanical Garden of South Hadley, Mass., and she mentions the visits of pollen-collecting honey-bees, (an introduced species), but not of any of our native insects. From all these facts I am forced to believe that spontaneous self-pollination is the rule in *Trillium grandiflorum* and that only a small percentage of the flowers becomes cross-pollinated.

***Trillium nivale* Riddell. Early Wake-robin.**

On a former occasion (23) I mentioned this species as being the earliest among our entomophilous flowers. The first flowers may be expected within the first two weeks in April, and in the exceedingly early spring of 1898 they appeared already on March 26. Neither before nor since the publication of the paper just cited have I ever succeeded in witnessing the visit of any insect to this pollen-flower, and spontaneous self-pollination is to all appearances the usual mode of pollination in our region. This is brought about by the recurving of the style until the stigma meets the anthers, but it takes place rather late, and this circumstance, together with the fact that the stigmas are at first situated above the anthers, points to cross-pollination as a possible outcome during the early life of the flower.

***Trillium erectum* L. Ill-scented Wake-robin.**

This species has been noticed in blossom from May 19 to June 1, but my observations do not cover its entire flowering period. It is of especial interest on account of the variation in color shown throughout its range. According to Britton's Manual the petals may be dark purple, pink, yellow, greenish or white.

23. S. Graenicher. Bull. Wis. Nat. Hist. Soc., Vol. I (new series), pp. 1-2.

Loew (24) considers the dark purple and ill-scented variety, a nauseous flower, and he informs us that the styles surpass the anthers, and that the former are bent backwards. Miss Carter (25) states of the dark variety with a disagreeable odor observed at South Hadley, Mass., that no nectar is secreted, that the stamens and pistils are of the same length, and that self-pollination is apparently the rule. She noticed four beetles on the older flowers and did not consider their presence of any importance. Weed (26) saw several species of flesh-flies feeding on the pollen of these flowers in New Hampshire, and he regards the latter as proterandrous and adapted to cross-pollination. Around Milwaukee *T. erectum* appears to my knowledge in the white variety only, and these flowers possess an agreeable sweetish odor, but they do not produce any nectar. Those examined measured 5 cm. across, and their stamens were 13 mm. long, 10 mm. of which were taken up by the anthers. The stigmas are situated somewhat above the latter, but they are gradually brought in contact with them when the branches of the style curve outward. I have seen a stigma in close touch with a dehiscent anther.

As set forth above these flowers offer only pollen to the visitors, and they probably attract very few of them. On May 24 I noticed a bumble-bee, a female *Bombus americanorum* Fabr., alighting on a flower hunting for nectar; not finding the desired object it immediately flew over to a neighboring flower of *Salomonias biflora* (see above) where it was more successful. Altogether the flowers of *T. erectum* seem to be poorly attractive to insects, and spontaneous self-pollination takes place probably in the majority of the cases.

***Trillium cernuum* L. Nodding Wake-robin.**

The white flowers are concealed beneath the leaves, and for this reason they are not as readily noticed as those of the species of *Trillium* already considered. I have met with these flowers on several occasions between May 22 and 27, and have not witnessed a single visit. They are as Miss Carter (27) has noted,

24. E. Loew. *Bluetenbiol.* Beitrage II., pp. 78-79.

25. A. Carter. *Loc. cit.*, p. 20.

26. C. M. Weed. *Ten New England blossoms and their insect visitors*, pp. 53-60 (1895).

27. A. Carter. *Loc. cit.*, p. 21.

slightly proterandrous, and in the fully opened nodding flower spontaneous self-pollination may easily result from the position of the recurving stigmas directly below the anthers. Small drops of nectar from the septal glands may be seen near the base of the ovary. A bumble-bee was observed by Miss Carter sucking nectar.

***Trillium recurvatum* Beck. Prairie Wake-robin.**

Robertson (28) has given an account of the pollination of this dark purple erect flower. Usually a number of plants grow together in patches in damp woods. The flowers of our region, blooming from May 15 to about June 1 agree in all details with those from southern Illinois as described by Robertson. The green sepals are reflexed, but the dark purple petals form an arch over the middle of the flower. The rigid anthers with their remarkably broad connective are very dark in color, and are inclined over the dark purple branches of the style. Pollen may fall directly on the stigmas, and this is one way in which spontaneous self-pollination is possible. It also takes place when the recurved stigma touches an anther lined with pollen, a procedure which I have witnessed in several older flowers. As Robertson remarks, the flowers possess neither nectar nor odor, in fact nothing to attract insects except possibly the purple color, and he expresses the opinion that they may be visited by small flies at night. On May 20 during the day I watched a fungus-gnat *Sciara exigua* Say (family *Mycetophilidae*) crawling around in a flower and coming in contact with both anthers and stigmas. Although such a visit may be favorable to pollination, the flies of this family can hardly be depended upon to pay regular visits to these flowers, and it is more than probable that in *T. recurvatum* spontaneous self-pollination is the method usually resorted to.

28. Chas. Robertson. Loc. cit., p. 273.

NEW CHALCID-FLIES FROM CAPE COLONY.

BY CHARLES T. BRUES

The following seven new species of Hymenoptera of the superfamily Chalcidoidea were sent to me by Dr. Hans Brauns of Willomore, Cape Colony. The types are in the Milwaukee Public Museum.

They represent an interesting addition to the very small number of Chalcids so far described from South Africa. Two form the types of new genera, while the others add three genera not hitherto recorded from that region.

FAMILY TORYMIDÆ.

SUBFAMILY ORMYRINÆ.

Ormyrodes gen. nov.

Body coarsely punctate, nowhere striate, the punctures at the base of the middle abdominal segments scarcely coarser than elsewhere. Abdomen very long, subulate, nearly three times as long as the head and thorax, with a strong median dorsal carina extending from the base of the third abdominal segment to the tip of the abdomen. Ocelli large, the lateral ones equidistant from the median one and the eye-margin. Eyes thickly pilose. Prothorax one-half as long and considerably narrower than the mesonotum, the latter with a slight depression on each side to indicate obsolete parapsidal furrows. Legs slender, tibial spurs small and delicate. Tarsi all rather distinctly spinous beneath. Wings with a long marginal vein, two-fifths as long as the submarginal. Stigmal one-third the length of the marginal, clavate and unusually oblique; postmarginal as long or longer than the marginal, attenuated gradually at the tip and continued as a faint thickening as far as the wing tip.

Type *O. carinatus* sp. nov.

The extremely long, awl-shaped abdomen, uniformly punctate body, hairy eyes, and long postmarginal vein in the wings will serve to identify the genus which falls close to *Ormyrus*. In sculpture of the body it resembles Förster's *Tribanus*; the latter is how-

ever not recognized by Mayr as generically distinct from *Ormyrus*.

***Ormyrodes carinatus* sp. nov.**

Female. Length 10 mm., of body 7 mm. Head and thorax bronzed green, the thorax with a reddish cast; abdomen seneous, varied with bluish and greenish, sides of the third segment anteriorly whitish pubescent, anterior angles of the fourth and fifth segments much more strongly so, the spots appearing olive green in certain lights. Base of the sixth segment deep orange, seventh metallic blue. Legs light rufous; coxæ greenish black, thickened parts of the femora, especially the posterior pair, blue-black; base of tibiæ and tarsi except tips pale yellow. Wings hyaline, with a very indistinct cloud below the stigma. Head coarsely, almost confluent punctured, covered with a whitish pubescence. Antennæ black, the pedicel and second flagellar joint of equal length, first flagellar one-third shorter, no ring-joint, fourth and fifth equal, the following decreasing, tip of antennæ broken off in the type specimen. Occiput, especially on the sides, circularly striate. Thorax and scutellum punctured like the head, the scutellum broadly rounded at the tip. Metathorax very short, scarcely visible above. whitish hairy and punctured on the sides. First and second abdominal segments smooth, except for transverse bands of fine punctures at the middle. Third rather deeply pitted with punctures the size of those on the thorax. The abdomen is suddenly constricted at the tip of this segment, the tip of the fourth segment being only one-quarter as wide as the base of the third. Third segment longest, fourth to seventh about equal, each two-thirds the length of the third. Venter distinctly, but more finely punctate. Ovipositor projecting to a distance equal to one-half the length of the pygidium, blunt at tip.

Described from one female collected at Uitenhage, Cape Colony, November 15, 1896.

FAMILY ENCYRTIDÆ.

SUBFAMILY EUPELMINÆ.

***Charitopus albopalpalis* sp. nov.**

Female. Length 3 mm. Head and thorax metallic green, abdomen beyond the first segment decidedly coppery. Legs brown or piceous; the anterior coxæ and trochanters, the spurs of the middle

and hind tibiae, extreme base of first joint of middle tarsus, hind trochanters and a very decided stripe on the outer side of the posterior tibiae, pale yellow or whitish. Antennae piceous, the flagellar joints except the last, yellowish brown. Mandibles brown, with black tips. Palpi whitish, the last joint long, swollen and bent at the base. Body slender; head transverse, two and one-half times as wide as thick and about as broad as high; front microscopically rugose, face shagreened. Eyes hairy. Antennae 11-jointed, the flagellum brown except the last joint, which is black. Scape piceous, thickened towards the middle, nearly one-half as long as the flagellum; pedicel a little shorter than the first and second flagellar joints together, ring joint wider than long. Third and following flagellar joints wider and shorter, the penultimate quadrate and one-half as long as the apical one. On the under side of the pedicel is a series of about ten very fine, long hooked hairs to be seen only under high magnification. Mesonotum shagreened, shining, the parapsidal elevations almost obsolete. Scutellum with a tolerably broad base on the mesonotum, its surface microscopically rugulose. Metanotum polished, the metapleuræ above with long white pubescence. Abdomen as long as the thorax, the posterior margins of the segments entire. Ovipositor projecting very slightly. Wings hyaline; submarginal vein two-fifths the length of the wing, twice as long as the marginal; postmarginal strongly developed, diminishing apically, but distinct to the apex of the wing; stigmal one-third the length of the marginal, knobbed at the tip.

One female, Algoa Bay Cape Colony, November 24, 1896.

The present species could be placed in no other described genus, but may possibly not be congeneric with the type of *Charitopus*. As it agrees in having no bristles on the middle metatarsi, scarcely any impression on the mesonotum, and long postmarginal vein, it seems to fall here. The spur of the middle tibia is well-developed but not especially long and I can not detect the "schildförmigen mittelbrustseiten" described by Förster (Hym. Stud. 11, p. 31) in his generic diagnosis of *Charitopus*, as more evident than in other Eupelmines. The peculiar hooked hairs on the antennal pedicel are different from anything I have seen.

***Parasolindenia* gen. nov.**

Female. Apterous, abdomen very strongly depressed, almost wafer-like; when seen from above oval, twice as wide as the thorax

and only one-half longer than wide. Ovipositor exerted. Head one and one-half times as high as wide and twice as wide as thick antero-posteriorly. Antennæ inserted low down on the face, very slender, with a white annulus on the flagellum. Face with a large, but very slight depression. Malar furrow present. Eyes bare, showing a faint pubescence only under a compound microscope; elongate-oval, convergent above. Ocelli in a rather small triangle, the lateral ones near to, but not contiguous with the eye-margin. Prothorax very much contracted in front. Mesonotum sloping very strongly in front, the parapsidal elevations very sharply defined, especially behind. Scutellum narrow, almost as long as the mesonotum, with a broad base against the mesonotum, the axillæ triangular, three times as long as wide in front, the outer edges of the two axillæ slightly converging behind. Scutellum narrowed behind the tips of the axillæ to a slightly rounded point. Posterior face of the metanotum with an irregular large anterior areola and a smaller posterior one. First to sixth abdominal segments of about equal length, the seventh short; posterior angles of the sixth and seventh roundly produced so as to make the tip of the abdomen quadridentate. Legs very short, the middle tibiæ with a large stout spur, their metatarsi spinose. Hind tibiæ with two very small, delicate spurs, one of them almost obsolete. Wings entirely absent. Type. *P. aptera*.

The type species is of very peculiar appearance due to its flattened abdomen and long, slender antennæ and legs. It falls near *Solindenia* Cameron, from which it differs by the complete absence of wings, very slender antennæ, and distinctly exerted ovipositor.

***Parasolindenia aptera* sp. nov.**

Female. Length 3.4 mm, width of abdomen 1.75 mm. Pale brown, the head bronzed black; the abdomen and pleuræ more or less bronzed. Head shining, but microscopically punctured or shagreened. Base of mandibles brownish. Antennæ 13-jointed, scape very slender, not at all thickened apically, rufous; flagellum slender, black, two and one-half times as long as the scape, its sixth and seventh joints pure white. Scutellum, axillæ, and anterior enclosure of the metanotum paler brown than the mesonotum. Abdomen fuscous, with indistinctly bronzed surface. Its surface has a silken appearance due to a thick appressed brownish pubescence over which are scattered

sparse, white appressed hairs; sides of the abdomen paler in color. Venter with a bluish cast, its pubescence sparse. Ovipositor as long as the apical two abdominal segments, pale with a black tip. Legs brownish, hind tibiae lined above with pale yellow; first two joints of hind tarsi, except the extreme base of metatarsus, whitish. Tips of all the tarsi blackish.

A single female from Willomore, Cape Colony.

***Eupelminus robustus* sp. nov.**

Female. Length 4-5 mm. Sub-opaque, piceous black, antennal scape, except the apex, annulus on antennae, middle coxae and trochanters, and the base of four hind tarsi honey-yellow, the markings of the legs being somewhat paler, especially apically. Head three times as wide as thick when seen from above, and a trifle longer than wide when seen from in front, its surface microscopically rugulose. Front above the antennae almost flat, scarcely impressed. Malar furrow distinct. Eyes oval, distinctly hairy, separated above by more than one-third the width of the head, the lateral ocelli near, but not contiguous with the eye-margin. Antennae slender, inserted considerably below the level of the lower eye-margin; flagellum slightly thickened apically, not quite twice as long as the scape, the single ring-joint as long as thick. Thorax very short, the mesonotum sharply declivous, the parapsidal elevations sharp. Prothorax as wide as long, transversely aciculated; mesonotum scarcely as long as wide; the scutellum so sharply declivous behind that its surface forms a right angle with the surface of the mesonotum. Axillae small, triangular, scutellum broad, finely rugulose, as is also the short, simple metathorax. Abdomen ovate, as wide as the thorax and two and one-half times as long as wide, subopaque and sparsely pale hairy; the upper surface and the venter both convex; six visible segments, the second to fifth of about equal length, their posterior margins not incised; sixth longer, rounded at the tip, and with a few scattered punctures, ovipositor slightly exerted. Venter more shining. Legs rather stout, the anterior femora slightly swollen; middle tibiae with a strong black spine, the middle metatarsi spinose; posterior femora swollen near the base, their tibiae of even width and distinctly arcuated. Wings very small and narrow, extending only to the tip of the metathorax; fuscous, with an oblique band near the apex. They are distinctly angled or broken near the middle.

One female from Algoa Bay, Cape Colony.

A species of rather remarkable aspect. The abdomen is convex above and shape and texture departs from the more typical Eupelminæ, recalling in superficial appearance certain Scelionidæ except that there is no lateral carina. It would seem similar in some ways to *Arachnophaga* Ashmead, which has no malar furrow; it is also fully winged.

Eupelmus nubifer sp. nov.

Female. Length 4 mm. Ovipositor 1 mm. Black, the head and the pleuræ strongly blue, the thoracic dorsum and abdomen less strongly bronzed. Scape of antennæ and legs varied with brownish yellow; ovipositor pale. Wings with a large fuscous cloud. Head two and one-half times as wide as thick, with a coarsely reticulate sculpture partially concealing a fine transverse aciculation. On the occiput and cavity of the face the reticulations disappear and the transverse aciculations show plainly; cheeks shagreened; clypeus with rugosities and punctures intermixed. Mandibles and palpi black. Flagellum of antennæ slender, a little more than twice as long as the scape, pedicel a trifle longer than the first flagellar joint; ring joint quadrate; flagellar joints gradually shortening, the penultimate quadrate, one-half as long as the apical joint. Prothorax evenly narrowed anteriorly, three-fifths as long as wide, obliquely aciculate on each side; mesonotum shagreened, with a trace of transverse aciculation anteriorly; parapsidal elevations parallel, very distinct but not sharp above, the posterior margin of the segment raised, then suddenly declivous and more or less distinctly trilobed. Anterior median elevation rounded in front and tapering to a point just behind the middle of the mesonotum. Scutellum rounded behind, with a moderately wide base against the mesonotum; scapulæ about two times as long as wide. Metathorax very short; pleuræ shagreened. Abdomen spatulate, the posterior margins of the basal segments strongly incised, not quite as long as the head and thorax together. Dorsal surface concave, except at the tip. Legs rather slender, blue-black; the middle and posterior trochanters, all knees, bases and tips of tibiæ, and tarsi except tips, honey-yellow or lighter. Marginal vein one-third longer than the submarginal; postmarginal and stigmal short, about equal, the stigmal curved and but slightly knobbed at the tip.

One female from Bothaville, Orange Free State, May 15, 1899.

The roughly sculptured head and clouded wings ought to make this species easily recognizable.

***Eupelmus volator* sp. nov.**

Female. Length 3.5 mm. Shining purplish black; trochanters, bases of femora, knees, base and tip of tibiae, and tarsi except tips, brownish testaceous. Wings hyaline, the venation pale. Head shining, the occiput finely transversely aciculate and the cheeks vertically aciculate; malar furrow very distinct. Antennae short, distinctly thickened toward the tip. Pedicel as long as the first flagellar joint and the ring joint together, the joints thereafter shortening and thickening, the sixth flagellar being quadrate; penultimate joint only one-third as long as the apical one. Eyes without trace of any pubescence. The insertion of the antennae is distinctly below the level of the lower eye-margin, and they are well separated at the base. Clypeus convexly elevated. Prothorax very short; mesonotum shagreened, with the parapsidal elevations broadly rounded above, slightly convergent behind, meeting the transverse posterior elevation in a curve; central elevation rounded, not acute behind. Metanotum with a large impression on each side, separated by a median carina. Pleurae shagreened. Abdomen not quite as long as the head and thorax together, concave above, the posterior margins of the basal segments deeply incised. Venter subopaque toward the base. Ovipositor as long as the head height, pale except at the extreme base and tip. Marginal vein about as long as the submarginal; postmarginal and stigmal subequal, each one-fourth as long as the marginal, the stigmal distinctly curved and but little enlarged at the tip.

One female from Port Elizabeth, South Africa, October 1, 1895.

This is possibly not a true *Eupelmus* on account of the entirely bare eyes, low insertion of the antennae, but it seems to belong nowhere else and I hesitate to erect a new genus for its reception.

***Eupelmus cursor* sp. nov.**

Female. Length 4.5 mm. Elongate, slender; apterous, except for very small wing pads which reach only to the tip of the scutellum. Black, more or less bronzed; the prothorax bright greenish-blue; antennal scape pale brown. Mesonotum brown, with metallic blue reflections behind; the elongate scapulae pale yellow; middle and pos-

terior legs with the trochanters, knees, tips of tibiae, and tarsi except tips pale yellowish. Head shining, shagreened, the facial depression with indications of transverse aciculation. Lower part of face golden or coppery, the clypeal margin slightly emarginate medially and edged with white hairs. Eyes faintly, but distinctly hairy. Prothorax twice as wide as long, concave above and polished. Parapsidal elevations very sharp, converging behind, the central portion longitudinally concave, without any indications of an anterior central elevation. Axillae rather approximated, the base of the scutellum therefore narrower than usual, as is also the entire scutellum. Metanotum shining, irregularly raised. Abdomen narrow, a little longer than the thorax, convex above and beneath; first dorsal segment incised behind, second only roundly emarginate, and third almost entire; surface shagreened. Ovipositor exerted only one-half the head height; stout, pale yellow. Legs slender, the spines of the middle metatarsi pale yellow, concolorous with the tarsal joint and not at all conspicuous, the metatarsus is enlarged in the usual way however. Middle tibial spur strong.

One female from Bothaville, Orange Free State, May 1, 1899.

This is a slender species much like the North American *E. dryorhizoxeni* Ashm. It differs from the *Eupelminus* described on a previous page by its very narrow body, aside from generic differences.

Public Museum,
Milwaukee, December 15, 1906.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. III.

By CHARLES T. BRUES.

ENCYRTIDÆ.

Eupelmus melanderi sp. nov.

Female. Length 3 mm. Ovipositor 1 mm. Black, varied with brown and greenish reflections; legs brownish; ovipositor pale. Head black with metallic greenish reflections especially strong on the vertex, those on the sides of the face purplish. Labrum and mandibles yellow, the latter with black teeth. Palpi black. Antennæ 11-jointed, rather stout, the flagellum a little more than twice as long as the scape. Scape pale yellow beneath, darker above and at tip, flagellum black; pedicel as long as the first flagellar joint, the ring-joint short, but nearly quadrate; the first, second and third flagellar joints gradually decreasing in length, the third about twice as long as wide at tip; fourth to seventh decreasing in length, the seventh about quadrate; last joint enlarged, spatulate and as long as the two preceding. Thorax brownish-yellow, the middle lobe and the scutellum more or less black with greenish reflections. Prothorax twice as wide as long, bilobed. Mesonotum three times as long as the prothorax, the parapsidal elevations very short and high. Abdomen as long as the thorax, shining black; ovipositor and its sheaths pale except at the extreme base. Wings aborted, very short, reaching only to a little beyond the base of the second abdominal segment, bent upwards at the base of the abdomen, their tips infuscated; subcostal vein distinct. Legs brownish-yellow, the tips of the middle and hind tibiæ and their tarsi whitish; hind femora darker at the middle.

Described from three female specimens sent me by my friend Professor A. L. Melander. He bred them from a gall of *Rhodites* sp. on *Rosa piscocarpa* at Pullman, Wash.

This is a close relative of *Eupelmus dryorhizoxeni* Ashm., a species abundant in certain parts of the eastern states. The

antennæ are shorter and stouter however, the wings not so sharply and peculiarly bent, the prothorax shorter, and the entire insect of much stouter habitus.

ICHNEUMONIDÆ.

Callidiotes kansensis sp. nov.

Female. Length 4.5 mm. Black, legs reddish-yellow, prothorax rufous, base of antennæ brownish, just beyond the middle with a pale annulus. Clypeus yellow, first three abdominal segments margined with ferruginous. Head twice as wide as thick; face slightly narrowed below; cheeks below almost smooth, white pilose. Clypeus oval, with a raised anterior margin, its upper edge distinctly separated from the face. Mandibles black at the tip, palpi pale. Antennæ 34-jointed, as long as the body, joints 11-14 whitish. Parapsidal furrows indistinct, uniting above the scutellum to form a depressed scabrous area; parapsides and anterior part of the mesonotum smooth. Scutellum punctulate, rufous. Pleuræ finely punctate, sericeous pubescent, hind margin of mesopleural piece with a row of submarginal punctures and with a deep impression above the middle. Metanotum rugulose, completely areolated, the basal and middle lateral areas separated. Abdomen distinctly petiolate, the first segment nearly three times as long as wide at the tip, longitudinally aciculate, with a lateral carina behind the spiracle reaching to the tip. Viewed from the side the upper margin is evenly arcuated. Second and third segments of about equal length, the second nearly quadrate and finely microscopically rugulose and aciculate. Third segment scabrous, remainder shining. Tip of abdomen yellow, the ovipositor projecting as far as the length of the hind metatarsus, its sheaths broadened except at the tip. Venter whitish. Legs, including coxæ, brownish-yellow; fourth and fifth tarsal joints of equal length. Wings hyaline, veins piceous, stigma piceous with a white base; radius originating beyond the middle of the stigma, areolet absent. Basal and transverse median nervure interstitial. Transverse median nervure of hind wings broken near the tip.

Described from one female collected at Lawrence, Kansas, during July by Mrs. E. S. Tucker.

This is the first North American species to be referred to this genus. It resembles *Mesoleptus albifrons* Cresson, on account of the annulate antennæ, but the metathorax is completely

areolated and the radial vein originates beyond the middle of the stigma. The abdomen is not entirely smooth as in the European species of *Callidiotes*, but the present form agrees in all other characters of generic value.

***Scopiorus monticola* sp. nov.**

Female. Length 5.5 mm. Black, with face, mandibles, first three antennal joints beneath, cheeks, palpi, tegulæ, antetegulæ, and venter, except for a median series of black spots, white. Legs, including coxæ, sternum, mesopleuræ and metapleuræ, except above, ferruginous. Apical two-fifths of posterior tibiæ and posterior tarsi from tip of first joint black. The clypeal suture and tip of mandibles are black and the white of the face medially emarginate above. Head and mesonotum smooth, polished, the former two and one-half times as wide as thick. Antennæ 27-jointed, almost as long as the body, acuminate at the apex and indistinctly broadened medially; first flagellar joint the longest, about four times as long as wide, remainder decreasing in length, the middle joints not quite twice as broad as long. Scutellum foveate at the base, the fovea smooth. Metathorax shining, almost smooth, very strongly areolated. Abdomen coriaceous at the base, apex of first segment and beyond smooth. First segment with a deep preapical transverse impression, the one on the second segment less deep and broader. Carinæ of first segment not reaching beyond the transverse impression. Second and following segments narrowly margined with white posteriorly. Wings hyaline, the veins piceous; stigma black with a white base. Ovipositor very short, yellow.

One specimen collected at Colorado Springs, Colorado, 5915 ft. Aug. (E. S. Tucker).

This species is related to *S. quebecensis* Provancher, but differs by the shorter carinæ on the basal abdominal segment as well as in coloration.

***Metopius birkmani* sp. nov.**

Female. Length 10 mm. Black, marked with yellow as follows: Anterior orbits, spot below tegulæ, line in front, scutellum except base, spot on post-scutellum, spot at side of metathorax near apex, spot above posterior coxæ, first abdominal segment, and wide posterior margins of segments two to six. Four anterior legs, including coxæ, reddish-yellow, the femora darker medially. Posterior legs black, with the upper side of coxæ, trochanters, tip of femora, and base of tibiæ

reddish-yellow, remainder of tibiae fuscous, tarsi ferruginous. Clypeal shield with a central carina; honey-yellow with a central black dot. Antennae rufous, 41-jointed, the scape and pedicel yellow below. Wings deeply infuscated but hyaline at the tip, i. e., beyond the second recurrent nervure. Stigma fulvous, veins piceous. The facial shield is somewhat less than twice as high as wide, rounded below, the sides nearly straight, converging; clypeus truncate. The antennae are short and stout, scarcely more than half the length of the body, the flagellar joints, toward the apex, at least three times as wide as long.

Male. Length 8mm. This sex is much lighter in color, with the wings more strongly infuscated. The legs are entirely yellow except for reddish blotches at the base of the hind coxae and at the middle of the hind femora. The pro-, meso-, and metapleuræ each have a large yellow spot that almost entirely covers them and there is a stripe just below the mesosternal suture. The mesonotum has a large yellow spot connected with a large triangular humeral yellow spot. The tegulae are also yellow. The facial shield is lemon-yellow, and slightly narrower than in the female. The antennae are 39-jointed, the flagellum ferruginous. The bands on the abdomen are wider, occupying nearly the entire second segment, two-thirds of the third, and more than one-half of the following ones.

Described from two specimens, male and female, from Fedor, Lee Co., Texas. They were sent to me by Rev. G. Birkman with a number of interesting Texan Hymenoptera.

The sexes are so dissimilar, that unless associated might be taken for distinct species. The present form resembles *M. rufipes* Cresson from Colorado, but the hind legs of the female are more or less black and the clypeal shield yellow while there is no rufous on the legs or abdomen

ALYSIIDÆ.

Asobara barthii sp. nov.

Length 1.75—2.25 mm. Black, the legs, first two joints of antennae, mandibles and legs, pale brownish-yellow. Prothorax and abdomen more or less piceous brown. Head shining black, almost twice as wide as thick. Mandibles bidentate, the outer tooth longer and a little curved. Clypeus projecting anteriorly, with a raised margin. Palpi whitish. Antennae 18-jointed in the female and 19-jointed in the male;

the scape, pedicel and base of first flagellar joint brownish-yellow. First and second flagellar joints about equal in length, the first stouter, third and fourth decreasing, remainder shorter, subequal, each about two and one-half times as long as thick; apical joint a trifle larger, oval and more slender. Thorax polished black, the propleuræ piceous. Mesonotum with more or less distinct furrows anteriorly, scapulæ each with a deep transverse groove. Mesonotum just in front of the scutellum with a fovea and occasionally with a trace of an impressed line connecting this with the depression at the base of the scutellum. This depression is broad and deep, rugose at the bottom, and undivided by any carinæ. Scutellum rounded at the tip and polished. Metathorax finely rugulose, not areolated, with indications of some irregular longitudinal carinæ anteriorly. Abdomen sub-petiolate, the petiole brown, gradually widened, twice as wide at tip as at base, sculptured above with irregular aciculations. Remainder of abdomen piceous, shining. Ovipositor of the female three-fourths as long as the body, its sheaths sparsely clothed with long hairs. Legs pale yellowish-brown, the posterior femora and tibiæ weakly clavate. Wings hyaline, the stigma narrow, but distinctly triangular in outline, about four times as long as wide. Radial cell extending to the tip of the wing, the first abscissa of the radius as long as the second transverse cubitus. First cubital and first discoidal cell separated, the first transverse cubitus also present. Second discoidal cell distinct and closed, although very narrow.

Described from many specimens of both sexes bred from the puparium of a Syrphid fly (*Temnostoma bombylans* Fabr.) issuing May 30, 1906, Milwaukee, Wis.

The puparium was collected under the bark of a fallen log by my friend Dr. Geo. P. Barth, after whom I take great pleasure in dedicating the species.

The present form differs considerably from the more typical species of *Asobara* and may perhaps find a more congenial place after the various genera of this group have been more exhaustively studied.

***Coelinus longulus* Ashm.**

In our collections are two males of this large species originally described from Colorado. They are from Nebraska and Wisconsin. In his description Ashmead states that the antennæ of the

type are broken. The complete appendages are 50-jointed and one and one-half times as long as the body.

***Dinotrema soror* sp. nov.**

Female. Length 1.75 mm. Black; legs, first abdominal segment and basal three joints of antennæ reddish yellow. Head twice as wide as thick, polished above, below the antennæ convex and punctured. Mandibles honey-yellow, with black tips; palpi whitish. Cheeks smooth and polished. Antennæ 19-jointed, first flagellar joint narrower, but considerably longer than the second which is twice as long as wide; following joints sub-equal, those near the apex a little shorter and slightly moniliform in shape. Mesonotum polished, without any traces of parapsidal furrows. The scutellum at base with a large transverse fovea divided by a delicate median carina. Metanotum rugose-reticulate, without carinæ. Spiracles round, very distinct. Abdomen sub-petiolate, three times as long as wide at tip, its surface roughened. Rest of abdomen polished; ovipositor projecting beyond the tip of the abdomen by somewhat less than the length of the first abdominal segment. Legs reddish-yellow. Wings hyaline, stigma linear, imperceptibly thickened basally and extending to the tip of the radius. First discoidal cell sessile; first and second abscissæ of the radius meeting at a distinct angle, the first abscissa and the second transverse cubitus about equal. First cubital cell almost quadrate, the second receiving the recurrent nervure and therefore five-sided. Subdiscoidal nervure originating well below the middle of the discoidal nervure.

Described from a female sent me a number of years ago by Mr. H. G. Klages, collected at Pittsburg, Pa.

The genus *Dinotrema* has never had any species referred to it so far as I know, and Förster designated no type. The present species runs into this genus in both the classification adopted by Ashmead and by Szépligeti, so I have followed the custom usually adopted with Förster's atypical genera and referred it here as *Dinotrema*.

***Orthostigma americana* sp. nov.**

Female. Length 3 mm. Black; under side of scape and pedicel, mandibles, palpi, tegulæ, and legs, luteous; the hind tibiæ and tarsi blackish. Head shining, two and one-half times as wide as thick, the temples full and the occiput concave. Face microscopically punctured, protuberant, sparsely whitish hairy. Mandibles tridentate, with a

triangular median tooth and two less distinct lateral ones. Antennæ very long, the flagellar joints nearly equal after the first two which are slightly longer and subequal, each being about four times as long as thick. Cheeks smooth and polished. Mesonotum smooth, with indistinct arcuate parapsidal furrows anteriorly, posteriorly with a deep medially elongated fovea which is almost confluent by its posterior point with the deep transverse scutellar fovea; the latter fluted along its bottom. Metanotum about as wide as long, not areolated or carinated, but irregularly and finely rugose. Pleuræ smooth and polished, the mesopleura below with a polished depression. Abdomen as long as the head and thorax; first segment microscopically roughened, the spiracular angles protuberant; about twice as long as wide at the apex which is one-half wider than the base; second and third shining, equal in length, the third widest; fourth and following narrowed to a point. Ovipositor shorter than the hind metatarsus. The abdomen is distinctly petiolate, convex above and not compressed apically, the second segment more or less brownish. Wings hyaline, the veins dark and very distinct. Radial cell closed at the tip of the wing, the stigma linear, but thickened and reaching to the middle of the radial cell, its sides parallel except at each end. First and second cubital cells separate, the second transverse cubitus about one-third the length of the second abscissa of the radius and equal to the first abscissa of the latter. Recurrent nervure received very near the base of the second cubital cell; second discoidal cell distinct, small and closed at apex, the subdiscoidal nervure not interstitial; submedian cell considerably longer than the median. Hind wings with the submedian cell one-half as long as the median along the costa.

Described from one female collected June 18, 1906, at Milwaukee, Wisconsin.

BRACONIDÆ.

Hormiopterus Giraud.

TABLE OF NORTH AMERICAN SPECIES.

1. Wings distinctly infuscated or banded..... 2
Wings pure hyaline, antennæ 30-jointed, ovipositor nearly as long as the body.....**claripennis** sp. nov.
2. Ovipositor shorter than the abdomen..... 3
Ovipositor one and two-thirds times the length of the entire body, wings with only a faint indication of a white band, antennæ 30-jointed, head and legs ferruginous....**caudatus** sp. nov.

3. Ovipositor two-thirds the length of the abdomen, anterior wings with a distinct white band, body entirely black.. *fasciatus* Ashm.
Ovipositor one-half the length of the abdomen, wings sub-fuliginous with some whitish streaks, but without a distinct white band, body dark fuscous varied with ferruginous.
aciculatus Cress.

Hormiopterus claripennis sp. nov.

Female. Length 4.5 mm. Ovipositor 4.25. Black, head, base of antennæ, prothorax, tegulæ and legs more or less ferruginous or fuscous. Head more transverse than usual, about one-half wider than thick. Occiput and vertex shining and very finely and distinctly transversely aciculated; cheeks polished; face with a delicate sculpture and covered with sparse glistening hairs. Eyes very large, their long diameter more than half the head-height. Antennæ very slender throughout, 30-jointed, the flagellar joints after the first decreasing in length, but the subapical ones are fully three times as long as thick. The joints are of even thickness and not easily counted. Palpi long, pale yellow. Mesonotum smooth, except for the crenulate sutures and furrows. Pleuræ very finely rugulose and whitish-hairy. Metanotum rugulose, with faint traces of areolation. Abdomen not quite as long as the head and thorax together, at the base two-thirds as wide as the tip of the metathorax. First segment two and one-half times as long as wide at apex, its surface coarsely longitudinally striated; basal two-thirds of second segment striated above, the striæ reaching the tip laterally; the oblique impressions are long and reach the basal margin of the segment. Apical margin of the segments shining. Ovipositor black. Wings clear hyaline, the veins and stigma piceous black. Submedian cell longer than the median, recurrent nervure almost interstitial, being received by the very tip of the first (not second) cubital cell; sub-discoidal nervure interstitial; second abscissa of the radius one-half longer than the first and two-thirds as long as the second abscissa of the cubitus. Legs, including coxæ, fuscous, the anterior legs, middle tibiæ, and all tarsi and trochanters ferruginous. Posterior tibiæ with a pale yellow annulus at the extreme base.

One female, Douglas Co., Kansas, Sept., collected by Mr. E. S. Tucker and sent by him for identification.

The hyaline wings and general appearance of this species remind one of *Hormius*, but the neuration is that of *Hormiopterus*.

***Hormiopterus caudatus* sp. nov.**

Female. Length 6 mm. Ovipositor 10 mm. Black, head, base of antennæ, prothorax, and legs ferruginous. Head full behind the eyes, its surface sub-opaque, finely rugulose, the occiput with faint transverse aciculations; cheeks nearly smooth and shining. Antennæ setaceous, the joints very distinct, 30-jointed, the flagellar joints decreasing in size regularly from the first which is four times as long as thick, while the sub-apical joints are but little longer than thick. Eyes very small, their diameter less than one-third the head height. Thorax subshining, black, the anterior part more or less fuscous; mesonotum faintly sculptured scutellum slightly convex at tip, with a fluted depression at the base; entire pleuræ rugulose. Metanotum rugose-reticulated, not areolated, with a median carina evident anteriorly but fading out behind, on each side of this are two very short carinæ anteriorly, parallel with the median one. Mesopleuræ with no smooth space. Abdomen almost as wide at base as the tip of the metathorax. First segment one and one-half times as long as wide at tip, the anterior angles each with a short longitudinal carina, surface irregularly striate longitudinally. Second segment one-half longer than the first, its anterior half longitudinally striate, especially towards the center, the oblique lateral impressions short and more nearly transverse than usual; apical segments smooth and shining. Sheaths of the ovipositor fuscous with black tips. Legs, including coxæ, entirely ferruginous. Wings infuscated; the stigma, except base and veins, piceous. From the base of the stigma there extends a narrow, more or less indistinct hyaline cross-band which has a branch extending along the second abscissa of the cubitus. Submedian cell longer than the median, subdiscoidal nervure straight, interstitial; recurrent nervure interstitial with the first transverse cubits; first and second abscissæ of the radius nearly equal, each about as long as the second transverse cubitus and one-half the length of the second abscissa of the cubitus.

Described from one female specimen from Fedor, Lee Co., Texas, April 26, 1904, (Rev. G. Birkman).

The species comes near to *H. aciculatus* Cresson, but differs on account of its very long ovipositor and different thoracic sculpture.

Public Museum,
Milwaukee, January 18, 1906.

A WEASEL NEW TO WISCONSIN'S FAUNA.

BY HENRY L. WARD.

Last November the Milwaukee Public Museum received as a gift from E. J. Wehmhoff, Esq., of Burlington, Wis., a small weasel in the flesh which Mr. Wehmhoff wrote had been "caught in the country in the act of killing a mole." The specimen had excited some interest and discussion as to its identity, which would indicate that it is not commonly observed. In conversation with the mother of the donor I am informed that her husband, Mr. Wehmhoff, has for forty years trapped all about Burlington and is consequently well informed as to the mammals of the region, but that he had never before seen or heard of this kind of weasel. From these facts it is not unlikely that the species is peculiar in its habits or is very scarce. Its small size probably militates against its being frequently taken in the ordinary traps intended for larger mammals; so that, after all, our knowledge as to its rarity is dependent on more or less fortuitous observation.

As the Museum possessed no specimens of short-tailed weasels for comparison it was impossible to make a satisfactory determination of the species, though from a consultation of the literature it seemed to conform very exactly with *P. rixosus* as described by Bangs in Proc. Biol. Soc'y., Wash., Vol. X. Its position in the extreme southern part of the state so poorly agreed with what is known of the geographical distribution of this northern species that it seemed hardly probable that in these times of close splitting of species by faunal areas it would be allowed as conspecific with *rixosus*.

In order to obtain a satisfactory determination I forwarded the specimen to Dr. C. H. Merriam, who writes under date of Jan. 9th: "I have just now examined the specimen in connection with our specimens of *rixosus* and *allegheniensis*. I regard *allegheniensis* as a subspecies of *rixosus*. Your specimen being in winter pelage does not show the dark belly of *allegheniensis*, but probably would have this character in summer pelage. It is a female and therefore does not show the skull characters to advantage. I regard it however as *allegheniensis*."

Considering this determination as authoritative the species should then be known as *Putorius rixosus allegheniensis* (Rhoads) which Rhoads, in Proc. Acad. Nat. Sci., Phila., Feb. 7, 1901, calls Allegheny Weasel and in his Mammals of Pennsylvania and New Jersey, 1903 p. 173 terms Alleghenian Least Weasel.

Our specimen is No. 1363, female, Nov. 26, 1906, Burlington, Racine Co., Wis. The measurements taken in the flesh are: length of head and body, normal, 150 mm.; under tension, 160; tail before skinning, 29; vertebral measurement as determined after skinning, 27; manus, 13; pes 21; ear, back, 4; ear, notch to tip, 11. Skull: condylar basilar length, 30; zygomatic width, 15; mastoid width, 14; interorbital constriction, 6.5.

The species is remarkable not only from its small size, but also because of the extreme shortness of its tail, the vertebral part of which does not reach to the end of the toes in the made up skin and the hairs extend only about 5 mm. beyond them. The end of the tail appears to be entirely devoid of any suggestion of the dark tip common to other species of weasels, but when held against a white background it can be seen that about one-third of the terminal hairs are dark in color.

The underparts to middle of sides are white. The upper parts extending on outsides of hind legs to the heels are mixed "walnut brown" and white; deepest brown on the occiput and nucha, becoming lighter posteriorly and also laterally from the vertebral region. Low on the sides anteriorly as well as all the posterior part of the back the brown is so mixed and interrupted by white as to produce a clouded effect.

This winter has been remarkably open, there being hardly a trace of snow up to the time that this weasel was captured, yet its change to winter pelage was well advanced.

A very large female *P. noveboracensis* taken Jan. 13th, 1907, a few miles north of Milwaukee, at Whitefish Bay, shows no indication of assuming its white coat, whereas a good sized male taken a few miles south of the city at Hales Corners on Nov. 11, 1906, had changed to about the same degree as shown in our *allegheniensis*. At no time up to the middle of January had the ground either at Burlington or about Milwaukee been entirely covered with snow and the little that had fallen had soon disappeared. The temperature had been exceptionally high for this period of year.

BULLETIN

OF THE
WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 5, New Series.

APRIL, 1907.

No. 2.

PROCEEDINGS.

Milwaukee, Jan. 10, 1907..

Meeting of the combined sections.

President Teller in the chair, and Messrs. Barth, Brues, Brundage, Case, Colles, Doerflinger, Graenicher and Ward present.

The secretary read the minutes of the last meeting, which were approved.

Dr. Case spoke of collecting fossil reptiles in Texas, and related some of his experiences there during the past summer.

Mr. Teller exhibited a beautiful specimen of millerite, a sulphide of nickel. It was an inclusion in a mass of calcite crystals.

Mr. Brues exhibited part of a lot of fossil insects belonging to the Harvard Museum. There was considerable discussion among those present regarding the rock in which the fossils are imbedded and concerning the extreme abundance of fossil insects at Florissant, Colorado.

The meeting then adjourned.

Milwaukee, Jan. 31, 1907.

Regular monthly meeting of the Society.

President Teller in the chair, and about fifty persons present.

Mr. Ward called attention to the suppression of part of the appropriation for the Biological Survey in the agricultural appropriation bill, then before Congress, and moved that the secretary be instructed to express the disapproval of the Society of such action to the Wisconsin Members of Congress. Motion seconded and passed.

Mr. Teller called attention to the fact that there would be a vacancy on the Board of Trustees of the Public Museum in May, 1907, when the term of office of one of the citizen members of the Board expires. As the state law requires that the Wisconsin Natural History Society

annually nominate a person for this office who shall be preferred by the Mayor for appointment, Mr. Teller asked that the Society take action on the matter.

Dr. Case said that this matter would require mature deliberation and moved that it be referred to the Board of Directors. Motion was seconded and passed without further discussion.

There being no further business, Mr. C. T. Brues addressed the meeting on the "Rôle Played by Insects in the Transmission of Certain Disease of Man and the Higher Animals." The speaker referred to the wonderful progress made during recent years toward an understanding of this matter and outlined the discovery, investigation and final proof of the connection between mosquitoes and malarial and yellow fever. He described the life history of the mosquito and of the malarial parasite which is the direct cause of malaria. The relation of the abundance of mosquitoes to proper drainage and sanitation was referred to briefly before turning to a consideration of certain insect-borne diseases of animals caused by small parasites known as trypanosomes. He closed his remarks with a discussion of the cause of the so-called Texas fever of cattle and the importance of this disease in the economic development of the southern part of the United States.

The meeting then adjourned.

DIRECTORS' MEETING.

After the regular meeting, a Directors' meeting was held and the name of Edw. W. Windfelder chosen for nomination as member of the Board of Trustees of the Public Museum. The secretary was ordered to transmit this decision to the Mayor.

Milwaukee, Feb. 10, 1907.

Meeting of the combined sections.

President Teller in the chair, and the following members present: Miss Torelle, Messrs. Barth, Brues, Case, Colles, Clowes, Doerflinger, Graenicher, Russell and Ward.

The secretary read the minutes of the last section meeting, which were approved.

Dr. Case opened the discussion with a description of certain Permian reptiles which he had been studying and collecting for a number of years. He referred particularly to a species of *Naosaurus* which had recently been mounted in the American Museum of Natural History. He told something of the history of the study of this peculiar

reptile and its relatives, and gave his most recent views concerning the probable cause for the remarkable developments shown by certain parts of the skeleton. The interesting geographical distribution of related Permian reptiles was also outlined.

Mr. Ward then exhibited a series of weasel skins from Wisconsin. He referred critically to the various records of species of weasels occurring in the state. He showed a skin of *Putorius rixosus allegheniensis* (Rhoades) from Burlington, Wis., a record which widely extends the known range of the species.

Mr. Brues then referred to a recent deviation in zoological nomenclature by a writer on a group of stony corals who considered it necessary to abandon binomial nomenclature and adopt a geographical series of names numbered according to the localities from which the species came.

The meeting then adjourned.

Milwaukee, Feb. 28, 1907.

Regular monthly meeting of the Society.

President Teller in the chair, and about 75 members present.

The minutes of the last regular meeting were read and approved.

Mr. Teller reported that a committee consisting of Dr. Graenicher and himself had called upon the Mayor regarding the appointment of a trustee for the Public Museum.

The secretary read an invitation from the seventh international congress of Zoologists for the society to be represented by delegates at its Boston meeting in August in 1907.

There being no further business, Prof. S. W. Williston of the University of Chicago, delivered a lecture on the phylogeny of the Elephant.

The lecturer described with the aid of lantern slides the evolutionary development of the Proboscidea to the modern elephants from the earliest known forms, recently discovered in Egypt, with the upper and lower incisors or tusks adapted for gnawing after the manner of rodents. The lower pair was gradually lost, while the upper ones became greatly increased in size. Their geographical migrations from Africa, through Europe to North America in recent times, and finally to South America, through the open land communication of the northwest and the Isthmus of Panama were traced. The numerous species inhabiting North America since late Miocene times were discussed, with a brief

history of the later elephants of the United States that have only recently disappeared. After the lecture President Teller thanked Professor Williston for his kindness in coming to Milwaukee to lecture, and expressed the great appreciation of the Natural History Society.

The meeting then adjourned.

Milwaukee, March 21, 1907.

Meeting of the combined sections.

In the absence of President Teller, Vice-President Ward presided.

Mr. George W. Colles spoke on the Classification and Origin of the Micas.

The term mica embraces a group of minerals which have certain marked chemical and physical characteristics, the principal of which is their cleavability into thin flexible plates. They are all compound hydrous silicates of aluminum and another base of a highly complex character. As is usual in complex minerals of this sort, the chemical composition is not fixed and invariable as in quartz, calcite and gypsum, and consequently to find a rational chemical formula which would embrace all the mica minerals was a very difficult matter. It was accomplished, however, by Mr. F. W. Clarke, who has given much study to the question of chemical formulas for minerals.

According to the old standard classification, which seems to have been followed by everyone who has written on the subject until the publication of Colles' work, all mica was divided into three sorts, termed muscovite, phlogopite and biotite. There is neither rhyme nor reason in such a classification as this. While the species known as muscovite and phlogopite belong in two separate groups, the term biotite either was applied to two different types or else it represented a type of which phlogopite was a mere variety. There are really two different main groups into which all the numerous species and varieties of mica that have been described naturally fall. Chemically, these are distinguished as monad and dyad types, that is, types in which the positive radicals are monads or dyads, respectively. Because of this difference in chemical composition the two classes have been called perissad and artiad micas, respectively, from the Greek words for "odd" and "even." In the perissad group the principal monad radicals are H, K, Li, Al(OH)_2 , AlF_2 , AlO , Fe''' , and in case of the semi-mica paragonite, Na. The principal dyad bases are Mg, Fe'' , AlOH and AlF .

These chemical differences correspond to certain physical and mineralogical differences which are likewise strongly marked, whence the two classes may be termed alkaline and magnesian, or again granitic and pyroxenic; or again igneous and aqueo-igneous. The first class occurs in granitic rocks; the second in pyroxene, especially in connection with calcite and apatite. Micas of the first class are comparatively hard, brittle and anhydrous; those of the second class are soft, flexible and contain slightly more water, which is more easily driven off by heat. Moreover, the alkaline micas are more often clear and transparent, but the magnesian are invariably colored, whence it arises that the latter are worthless for glazing purposes, which has been until recently the principal commercial use of mica. It was not, therefore, until the development of the electrical industry that this magnesian mica came to have a commercial value.

It is remarkable, however, that while the granitic micas are of common occurrence in all parts of the world, the magnesian micas are comparatively rare, and there is only one district where they are at present mined, this being the Laurentian of Canada.

The circumstance of formation and the difference of the deposits point clearly to an absolutely different mode of origin of the alkaline from the magnesian micas. While different theories have been put forward to account for the former, the weight of evidence seems to show an origin by metamorphism and heat alone, probably accompanied by great pressure in the cases where large crystals are formed. The origin of the magnesian micas, on the other hand, is far from clear, but it is certain that it was absolutely different from that of the alkaline micas; and the most likely theory seems to be that they were formed near the surface from or in connection with a magnesian magma with the aid of hot water, steam and gases.

The speaker alluded to the existence of numerous facts in support of the theories and conclusions given, which, however, could not be stated in details in a short discussion.

After some discussion on the part of several members, Mr. Charles H. Doerflinger spoke on some recent archeological discoveries in Southern France.

The following papers were ordered printed by the Board of Directors:

NOTES ON A NEW GUEST-ANT, *LEPTOTHORAX*
GLACIALIS, AND THE VARIETIES OF
MYRMICA BREVINODIS EMERY.

BY WILLIAM MORTON WHEELER.

In two former papers* I described the habits of *Leptothorax emersoni*, a small yellowish Myrmicine ant, which lives in interesting symbiotic relations with *Myrmica rubra brevinodis*, a larger brown species of the same subfamily. The *Leptothorax* occupies small cavities, communicating by means of tenuous galleries with the more spacious chambers and galleries of the *Myrmica*, and, while freely and intimately consorting with its host, is very careful to keep its own brood isolated. This small ant feeds, as I have shown, partly on the oleaginous secretion covering the bodies of the *Myrmica* workers, whom it licks and sham-poops with comical assiduity, and partly on the liquid food which, after submitting to this treatment, these insects regurgitate.

L. emersoni was first discovered among the Litchfield Hills of Connecticut, at altitudes varying from 1,000 to 1,600 feet, but subsequently I found it also at similar elevations in the Berkshire Hills of Massachusetts. More recently, Mrs. Annie Trumbull Slosson took a single winged female on the summit of Mt. Washington. These facts indicate that the species belongs to the sub-boreal or alpine fauna, a conclusion which is confirmed by a study of the distribution of its host ant. As this host is extremely common in the Rocky Mountains and apparently also throughout British America, I fully expected to find the *Leptothorax* occurring over much of the same territory, but, although during the summer of 1903 I collected ants extensively in Colorado at alti-

*The Compound and Mixed Nests of American Ants. Amer. Natural. XXXV, 1901, pp. 431-415; and Ethological Observations on an American Ant (*Leptothorax Emersoni* Wheeler) Arch. f. Psych. u. Neurol. II, 1903, pp. 1-31, 1 Fig.

tudes varying from 5,000 to 10,000 feet, I never once saw a specimen. During the summer of 1906, however, while collecting in Florissant Cañon, at an elevation of 8,500 feet, I came upon a flourishing colony of *M. brevinodis* spread out under a group of five flat stones on the grassy bank of a stream and containing numerous workers, a few callow females and males, and many larvæ and pupæ of a *Leptothorax*, which, on account of its very dark color, I at first took to be an undescribed species. Closer examination, however, showed that it might be regarded more properly as a subspecies of the New England *emersoni*. The host, too, was found to differ in several minor characters from the eastern form of *M. brevinodis*. A portion of the Florissant colony was taken alive and kept for six weeks in an artificial nest for the purpose of observing the behavior of the ants. My notes on this colony will be recorded below, after a description of the new subspecies of *Leptothorax* and a revision of the varieties of *M. brevinodis*. It was necessary to make this revision in order to gain a clearer conception of the taxonomic affinities of the host ants to each other and to the other varieties of the subspecies.

***Leptothorax emersoni glacialis* subsp. nov.**

The worker measures 3-3.5 mm. in length and differs from the worker of the typical *emersoni* in the following characters: the mesonotum is distinctly less convex so that the thorax in profile is more like that of *L. acervorum*, and the hairs are less abundant and somewhat more reclinate on the antennæ and legs. As in the typical form, many of the hairs on the body and tibiæ are obtuse, but not clavate. The head and gaster are black, the thorax, upper portion of the petiole and postpetiole, and the extreme base of the gaster, dark brown; the legs, antennæ, clypeus and mandibles are yellowish brown, the clubs of the antennæ infuscated. The worker is less variable in size, and individuals with ocelli are much rarer than in the typical *emersoni*.

The female is no larger than the worker and of a very similar color, except that in mature specimens the thoracic dorsum is as dark as the head and gaster.

The male measures 3 mm. and is black throughout, except the tarsi and articulation of the legs, which are sordid yellow. The mandibles

are more pointed, and the thorax is more robust than in the male of the typical form. The pronotum and scutellum are much more opaque and heavily sculptured, the former being densely punctate and rugose, with three shining streaks, one down the middle and the others over the parapsidal furrows. The scutellum and epinotum are densely reticulate-punctate. In the typical *emersoni* the pronotum is shining, distinctly foveolate in front and rugose-punctate behind. The wings of *glacialis* are larger, broader and more whitish.

L. emersoni and its subspecies belong to a small group of the genus characterized by 11-jointed antennæ in the worker and female and a distinct though feeble constriction of the thorax at the mesoëpinotal suture. For this group, which comprises also the circumpolar *L. acervorum*, *muscorum* and *hirticornis*, and the neoboreal *provancheri*, Ruszsky* has recently erected a distinct subgenus, *Mychothorax*. *L. emersoni*, is evidently very closely related to *L. provancheri* Emery, but the latter is said to have clavate hairs on the tibiæ, whereas in the former the hairs both on the body and tibiæ, though often obtuse, are never clavate. As Emery described *provancheri* from a single specimen, this species, when more specimens are available, may prove to be conspecific with the one I have called *emersoni*.

Examination of several hundred specimens from a large number of colonies of *Myrmica rubra* from different parts of North America convinces me that Emery† was right in concluding that the true palearctic *M. rubra sulcinodis* Nyl. does not occur in this country, but is replaced by a distinct subspecies, *brevinodis*. Of this Emery distinguished two forms, the typical *brevinodis* and a variety which he called *sulcinodoides*, because it approaches the European subspecies somewhat more closely. More recently Forel

*The Ants of the Russian Empire. Kasan, 1905, p. 609 *et seq.* (in Russian).

†Beiträge zur Kenntniss der nordamerikanischen Ameisenfauna. Zool. Jahrb. Abth. f. Syst. VIII, 1894, pp. 312, 313.

‡Descriptions of Some Ants from the Rocky Mountains of Canada. Trans. Ent. Soc. Lond. 1902, pp. 699, 700.

has described a second variety, *frigida*, from British Columbia. The North American *brevinodis*, like the European *sulcinodis*, is restricted to the mountains, though in the Northern States one of its varieties occasionally, and in British America probably more generally, descends to much lower elevations. The worker and female of *M. brevinodis* differ from *sulcinodis* in the shape of the antennal scape, which even in the variety *sulcinodoides* is more uniformly and gracefully bent at the base. The males of all the forms of *brevinodis* I have seen, have the scape unusually short, never more than a third and often only a fifth or sixth as long as the funiculus, whereas the scape of the male *sulcinodis* is nearly half as long as the remainder of the antenna. The body of the male *brevinodis* is, moreover, always deep black, whereas it is more or less red or brown in the European subspecies. Although even in single colonies the size, sculpture and color of the individuals may vary considerably, I am able to distinguish the following varieties among the specimens in my collection:

1. *Myrmica rubra brevinodis* Emery, (typical).

This form was based on some workers from Salt Lake, Utah. Emery's description agrees very closely with a form which is not uncommon in Colorado, at altitudes below 7,000 feet, nesting in the sandy and gravelly banks of streams. The male described by Emery cannot belong to this, or indeed to any other form of *brevinodis*, on account of the great length of the antennal scape, which is recorded as "not quite as long as half of the funiculus." The following description is drawn from specimens belonging to a single colony:

Worker. Length 4—4.5 mm. Antennal scape evenly bent at the base, not angular and not compressed, gradually enlarged distally. Epinotum with well-developed, rather slender and curved spines, which are nearly as long as the base of the segment. Petiole short, less than twice as long as broad, in profile with gradual, concave, anterior slope, rather acute summit and angularly convex posterior slope. Sculpture of body moderately strong; rugæ on upper surface of head sharply longitudinal and reticulate, on the occiput and sides of head reticulate

only; the interrugal surfaces over the whole region finely and rather feebly punctate. Thorax with coarse, regular, longitudinal rugæ except on the sides of the pronotum where the surface, at least behind, is uniformly and densely punctate. Petiole and sides of postpetiole longitudinally rugose, node of latter smoother and densely punctate, finely striated or sometimes slightly glabrous. Hairs moderately abundant, slender and pointed. Body and appendages red; gaster with a broad dark brown or blackish band across the middle.

Female. Length 5—6 mm. Antennæ and sculpture of head like those of worker; thorax more sharply longitudinally striated above. Head, thorax, pedicel and appendages red; gaster black or dark brown; an anteromedian and two parapsidal blotches on the mesonotum, the metanotum, and posterior border of the scutellum, black. Nodes of petiole and postpetiole and in some specimens also the upper surface of the head dark brown. Wings dilute yellowish at the base, with pale brown veins and stigma.

Male. Length 4.5—4.8 mm. Scapes straight, rather stout, about $\frac{1}{3}$ as long as the funiculus, and as long as its five basal joints together; club 4-jointed. Hairs white, very slender, rather long and abundant, erect or suberect on both the body and appendages. Body black; tarsi, mandibles, genitalia and articulations of the legs yellowish; antennæ reddish brown. Wings white, very faintly yellowish at the base, with pale yellow veins and stigma.

Colorado: Colorado Springs, 5,990 feet (Wheeler); Boulder, 5,347 feet (T. D. A. Cockerell).

2. Var. *brevispinosa* var. nov.

Worker. Resembling the preceding in stature and color, but with very short spines which are not longer than half the basal surface of the epinotum and with more irregular, vermiculate thoracic rugæ.

Female. Somewhat paler than the typical form. The anteromedian blotch of the mesonotum is lacking and the gaster is red, with a broad brown band across its middle. The epinotal spines are hardly longer than broad at their bases. Wings colored like those of the typical form.

Male. Scapes somewhat curved and constricted at the base, about $\frac{1}{4}$ as long as the funiculus and as long as its four basal joints together.

Colorado: Cheyenne Cañon, 8,500 feet, and Colorado City, 6,064 feet (Wheeler); Cañon City, 5,329 feet (P. J. Schmitt).

New Mexico: Las Vegas, 6,398 feet, and Pecos, 6,366 feet (T. D. A. Cockerell).

The specimens from Pecos (two workers) have unusually short spines, which are hardly longer than broad at their bases.

3. *Var. decedens* var. nov.

Worker. Length 3.5—4 mm. Scapes evenly curved at the base as in the typical form. Spines short, straight and acute, somewhat more than half as long as the base of the epinotum. Sculpture of head as in the typical form, but the thorax above vermiculately and reticulately, instead of longitudinally rugose; sides of pronotum densely punctate, meso- and metapleuræ longitudinally rugose. Sculpture of petiole and postpetiole as in the typical form. Body and appendages yellowish brown; head dark brown or blackish above; gaster black.

Male. Length 4.5 mm. Scapes straight, nearly $\frac{1}{3}$ as long as the funiculi. Wings uniformly whitish hyaline, not suffused with yellow at the base; veins and stigma very pale brown.

Colorado: Buena Vista, 7,900 feet, and Florissant, 8,500 feet (Wheeler).

Colonies rather small, nesting under stones in grassy places on the banks of streams.

4. *Var. sulcinodoides* Emery.

Emery included more than one variety under this name, as shown by the localities which he cites (South Dakota, Utah, Maine). I would restrict the name to a distinct, large and dark-colored form, which is very common in the Rocky Mountains, at an altitude of 8,000 to 10,000 feet under stones and logs along the margins of subalpine streams and meadows. The larvæ and immature pupæ of this form have a peculiar greenish yellow color and oily luster, which I have not observed in any of the other varieties. Emery's statement that *sulcinodoides* approaches the European *sulcinodis*, is true of the worker but not of the male, which has extremely short antennal scapes.

Worker. Length 4.5—5.3 mm. Antennal scapes with a distinctly angular bend at the base, which is narrow and somewhat compressed. Spines as long as the base of the epinotum, slender, straight, acute and diverging. Sculpture strong; rugæ on the sides of the head

reticulate and not longitudinal, those on the thorax somewhat reticulate above, but longitudinal on the sides, even of the pronotum. Petiole and postpetiole sharply and longitudinally sulcate, the node of the latter sometimes more finely and irregularly rugose or more or less punctate. Hairs yellow, acute, rather short and moderately abundant. Head and gaster black; thorax, petiole and postpetiole deep red or, in some colonies, almost black; mandibles, antennæ and legs of a somewhat lighter red.

Female. Length 6—6.5 mm. Resembling the worker. Spines as long as the base of the epinotum, straight, rapidly tapering and blunt at their tips. In some specimens the thorax is entirely black, like the head and gaster, and there is a black spot on each node of the pedicel; in others the thorax is deep red, with the mesopleuræ, metanotum, posterior border of scutellum and the mesonotum, except for a pair of small red anterior and a larger posteromedian spot, black. Wings distinctly brown at the base, with light brown veins and stigma.

Male. Length 5.5—6 mm. Scapes very short and straight, only about $\frac{1}{6}$ as long as the funiculus and as long as its two basal joints. Club distinctly 5-jointed. Hairs yellow, long and abundant, especially on the legs. Body and appendages black; antennal clubs dark red, tarsi dark brown, articulations of legs yellowish. Wings like those of the female.

Utah: (Emery).

Colorado: Florissant, 8,000-9,000 feet; Cheyenne Cañon, 5,990 feet (Wheeler); Westcliffe, 7,849 feet, and Boulder, 5,347 feet (P. J. Schmitt); Ward, 9,000 feet, and Half-way House, Pike's Peak (T. D. A. Cockerell).

New Mexico: Top of Las Vegas Range, 11,000 feet; Harvey's Ranch, Las Vegas Range, 9,600 feet; Beulah, 8,000 feet; (T. D. A. Cockerell), Beatty's Cabin, Upper Pecos Valley (Mrs. W. P. Cockerell).

5. *Var. canadensis* var. nov.

Worker. Length 4—5 mm. Differs from the variety *sulcinodoides* in its somewhat smaller size and in the coloration, which is yellowish brown, with the upper surface of the head and the gaster, except at the base and tip, dark brown or blackish. The sculpture on the head is somewhat weaker, the hairs on the body slender and pointed.

Female. Length 5—5.5 mm. Resembling the worker. Thorax yellowish brown with the metanotum, posterior border of scutellum, an anteromedian, often double, blotch and two large parapsidal blotches on the mesonotum, black. Wings distinctly brown at the base, with brown veins and stigma.

Male. Length 5—5.7 mm. Closely resembling the male of the var. *sulcinodoides*, and with equally short antennal scapes. The wings, however, are of a deeper brown at their bases, the mesonotum is more densely and more extensively striated, and the hairs on the legs are shorter and stiffer.

Connecticut: Colebrook, Litchfield County, 1,000-1,600 feet.

Massachusetts: New Boston, Berkshire County, 1,400 feet.

Maine: (Pergande); Ogunquit (H. S. Platt).

Pennsylvania: Lehigh Gap.

Michigan: Marquette (M. Downing); Isle Royale (O. Gleason).

Wisconsin: Milwaukee (C. E. Brown).

Nova Scotia: Digby (J. Russell).

British Columbia: Golden (W. Wenman).

This is the only form of *brevinodis* which descends to lower levels in the Northern States. Transitional forms between it and the true *sulcinodoides* undoubtedly occur. Females from several of the Nova Scotia colonies have the thorax nearly black, and the workers of many colonies from the same region are almost yellow, with only the posterior portion of the head and a broad band across the gaster dark brown. The var. *canadensis* rarely reaches as great a size as the variety to which I have restricted the name *sulcinodoides*, and nests in cool bogs or meadows, under stones or logs. Its larvæ and young pupæ are pearly white and not greenish yellow.

6. Var. *subalpina* var. nov.

Worker. Length 4—5 mm. Resembling *canadensis* in color but differing both from it and *sulcinodoides* in having the hairs on the body obtuse, instead of pointed, and somewhat stouter than in the other varieties.

Female. Length 4.8—5 mm. Colored like the female of *canadensis*, but with the wings whitish hyaline throughout, with very pale brown

veins and stigma, and the upper surfaces of the petiole and postpetiole black.

Male. Length 4.3—4.8 mm. Closely resembling the male of *canadensis*, but with the wings colorless at the base as in the covarietal female.

Colorado: Florissant Cañon, occurring at a higher level (8,500) than *sulcinodoides* and replacing this variety along the margins of some of the streams and meadows.

7. Var. *frigida* Forel.

According to Forel, the worker of this variety has "the head longitudinally rugose, also at the sides, and nearly without transversal reticulations (in the typical *brevinodis*, the sides of the head are more reticulated). The abdomen highly polished, with only a few scattered erect hairs (more hairy and with slight scattered punctures in the typical *brevinodis*.) The whole body less hairy than in the typical *brevinodis*. Red; the abdomen and the upper side of the head brown. In all other parts like the typical form of the subspecies.

"Ice River Valley, British Columbia, 5,000 feet." [Edw. Whymper].

A single worker from Homer, Alaska, (A. Mehner) and a number of workers and males from the Bay of Islands, Newfoundland (L. P. Gratacap) in my collection agree very well with Forel's description. The color of the workers and the shape of the antennal scapes are the same as in the var. *sulcinodoides*. The sculpture is also very similar, except that the sides of the head are longitudinally rugose, and the petiole is coarsely longitudinally rugose in front and transversely rugose behind. In the male, the scapes are very short, not longer than the two succeeding joints together, or $\frac{1}{6}$ of the funiculus. The hairs on the body and legs are nearly white. Length of worker, 4.8—5.3 mm; of the male, 5.5—6 mm.

The host of the typical *Leptothorax emersoni* is the variety above described as *canadensis*, that of *L. glacialis* the var. *subalpina*. I have been unable to detect any differences in the habits or behavior of these two host ants. The nest of the Colo-

rado variety resembled in every way that of the Connecticut form, and the small nests of *L. glacialis* were arranged around the periphery under the edges of the stones in the same manner as those of the typical *emersoni* in the bogs of the Litchfield Hills. That the habits of the Western inquiline, however, are somewhat different from those of the Eastern type, is indicated by the following notes on the colony kept under observation in an artificial nest from July 17th to August 31st.

The artificial nest was of the design which I have described and figured in a former paper.* and consisted of two chambers of the same size, one of which was kept dry and illuminated, the other darkened and kept moist with a slice of sponge soaked in water. The installed colony consisted of the broods of both species, about a hundred *Leptothorax* workers, and a few males and females, and about seventy-five *Myrmica* workers. The queen of the latter species escaped while the ants were being collected. As soon as the ants and their broods, together with some of the earth in which they had been living, were placed in the lighted chamber, the *Myrmicas* hastened to transport their own larvæ and pupæ to the dark chamber. The *Leptothorax*, however, remained behind, and by the following day had hollowed out a small cavity in the earth and had brought into it all their young. This cavity was immediately beneath the glass roof-pane and fully exposed to the light. The *Myrmicas* kept visiting the *Leptothorax* continually, but the latter pulled the intruders by the forelegs or antennæ, and in every way showed the same desire to be left alone in their own habitaculum, as I have observed, under similar circumstances, in the Eastern *emersoni*. The *Myrmicas* endured no end of tweaking and pulling, but nevertheless kept pushing their way into the *Leptothorax* cavity as if unable to forego the society of their little inquilines.

Although so jealously guarding their own habitaculum against

*On the Founding of Colonies by Queen Ants, with Special Reference to the Parasitic and Slave-Making Species. Bull. Am. Mus. Nat. Hist. XXII, 1906, p. 48, fig. 1.

the intruders, the *Leptothorax* workers did not hesitate to enter the chamber in which the *Myrmicas* had taken up their abode. There they ran about, accosting the *Myrmicas*, which had gorged themselves with the sugar water in the manger in one of the corners of the chamber. The *Leptothorax* mounted their backs, shampooed their bodies and then, turning to the ventral side, promptly placed their tongues in contact with those of their host and imbibed the regurgitated sweets. The shampooing, however, was of much briefer duration and much more perfunctory than in the colonies of the typical *emersoni*. Often the *glacialis* worker omitted these manipulations altogether and went at once to the mouth of its host. Sometimes as many as five or six of the little ants would remain standing on the floor of the nest and drink simultaneously from the tongue of a single *Myrmica*. If the host failed to proffer the droplet of food, the *Leptothorax* would usually pinch her fore leg or antenna, and this more emphatic and probably more painful appeal rarely failed to elicit the desired response. The *Leptothorax* undoubtedly obtained all of their food from their hosts, for during the entire six weeks they were under observation, I never found one of them eating from the manger, or even showing the slightest interest in its contents. In the privacy of their own quarters, however, they freely fed one another by regurgitation with the food they had obtained from the *Myrmicas*.

As by July 20th the *Leptothorax* had shown no disposition to move their brood into the dark chamber with the *Myrmicas*, I undertook to coerce them by exposing their quarters to the bright sunlight. Even this had no effect, till the glass roof-pane became heated, when they slowly and reluctantly took up their larvæ and pupæ and migrated into the dark chamber. Then the entrance between the two chambers was closed. I expected the *Leptothorax* to establish themselves in one of the larger cavities of the sponge, as had been done by some of my colonies of the typical *emersoni*, but they merely stacked their brood in three piles at the end of the sponge. Here they were, of course, fully exposed to the *Myrmica* workers and the latter began to visit them assiduously. The

presence of the brood, however, caused the *Leptothorax* to react by pulling and tweaking the fore legs and antennæ of their visitors. By the following day they had brought all their laræ and pupæ together in a single pile on the side of the sponge opposite that occupied by the *Myrmicas* and their brood.

July 23rd I left Florissant, and for several days traveled about in Colorado, carrying the nest in my luggage. The jarring of the railway train must have had a tendency to mingle the broods of the two species, for during the night of July 23rd to 24th, the *Leptothorax* built a wall of agglutinated sugar crystals about 4 cm. long, parallel with and about a cm. from the edge of the sponge. This wall they were apparently unable to carry up to the roof-pane, so that the long, narrow chamber which they had endeavored to construct, and in which they had placed their brood, was open above and at both ends. The visiting *Myrmicas* were in no wise restrained by the crystalline rampart, but in their uncontrollable craving to be near the littleinquilines kept climbing over it or pushing their way into the openings at the ends.

No change was observed in the relations of the two species till I reached Colorado Springs, July 26th, when I found that the *Leptothorax* had abandoned their useless abode at the edge of the sponge and had moved their brood in under a delicate film of sugar, which they had built inside the food-cup. This film was fastened to the floor and to the vertical wall of the cup, so as to enclose a triangular cavity, which communicated with the outside by means of a single small opening. Structurally this little cell was, of course, an admirable contrivance for preventing the visits of the *Myrmicas*, but, unfortunately, by August 1st, its sugar wall had been partly dissolved by the moisture in the chamber, and partly eaten by the host ants, so that the little guests and their brood were again exposed on all sides. They now gave up all attempts at keeping their brood sequestered, and by August 3rd, when I arrived in New York, to my surprise, both species had collected and mingled their broods together in a single large cavity in the sponge. Henceforth, till all of the pupæ of both species had hatched, the workers of one species did not hesitate

to seize and carry the offspring of the other indiscriminately, although up to this time neither had shown the slightest interest in the brood of the other. By reversing the illumination of the chambers and keeping damp sponges in both of them, it was possible to make the ants move back and forth from one to the other, but, although this was repeated on several successive days, the ants always ended by keeping their brood intermingled, either at the edge of the sponge, or in one of its cavities. The original compound nest had, therefore, been converted into a mixed colony. This was quite unexpected, as I had found it extremely difficult to bring about such a result in my colonies of the typical *L. emersoni* and *M. canadensis*. The rapidity of this conversion may have been connected with the condition of the inquiline and host broods, for at the time of its occurrence all the larvæ had become pupæ, and many of these were pigmented and ready to hatch. The presence of eggs or larvæ among the *Leptothorax* brood would probably have rendered such a fusion of the two colonies impossible.

Early in August a few males and females of the *Leptothorax* and seven males of the *Myrmica* made their appearance. The behavior of the inquilines towards the latter was the same as towards the workers. The little ants shampooed these black-winged creatures and licked their mouth-parts, but I was unable to ascertain whether any food was regurgitated. The *Leptothorax* were always on hand whenever a *Myrmica* male was being fed by a worker of its own species. Sometimes the guests would congregate in numbers and lap up portions of the food as it was passing from the tongue of the worker to that of the male.

August 10th I isolated twenty of the *Leptothorax* workers and a few of their pupæ in a nest provided with honey and a few dismembered house-flies. The ants lived for a few days in a cavity of the sponge till their pupæ had hatched and then wandered aimlessly about the nest. They were never seen to approach the food in the manger and gradually died one by one before the end of the month. This result was very different from that obtained with isolated colonies of the typical *L. emersoni*, for these soon

learned to eat from the manger and lived several months as a pure colony.

During August the gaster of one of the larger *Myrmica* workers in the original nest became unusually distended, and as small packets of eggs were continually appearing and being as rapidly devoured by the workers, I concluded that this unusual individual had become gynæcoid and was trying to function as the queen of the colony. At the end of the month, after all the brood of both species had hatched and the ants had become demoralized, as usually happens when there are no young on which to concentrate their attention, I discontinued my observations. The gynæcoid worker was dissected and found to contain a number of mature eggs.

The above observations indicate that the habits of *L. glacialis* are similar to those of the typical *emersoni*, although differing in two important respects: first, the Colorado form feeds less on the surface secretions of its host and more on regurgitated food; and, second, this ant seems to have lost the instinct to secure its food in any other way. If further observations should prove that these differences are common to all colonies of *L. glacialis*, and not an idiosyncrasy of the colony which I happened to have under observation, or due to the depressing and demoralizing effects of confinement in an artificial nest, we should be justified in concluding that this subspecies has reached a more advanced stage of inquilinism or parasitism than the typical form of the Eastern States.

American Museum of Natural History,
New York City, March 9th, 1907.

WISCONSIN FLOWERS AND THEIR POLLINATION.

II.

BY S. GRAENICHER.

SAXIFRAGACEÆ AND GROSSULARIACEÆ.*

FAM. SAXIFRAGACEÆ.

Saxifraga Pennsylvanica L. Swamp Saxifrage.

The genus *Saxifraga* is represented by a very large number of species in Europe, and for many of these their relations to insect visitors have been recorded, while for our North American species this has not been done in a single instance. The only one occurring in our immediate neighborhood is the species named above. It is fairly common in swampy grounds, and is rather large for a saxifrage, some specimens attaining a height of about 1 m. In the Menomonee Valley, between Milwaukee and Wauwatosa, the plants were seen in blossom from May 15 to June 18. The numerous small flowers (about 5 mm. in diameter) are arranged in cymes, and the latter form a long panicle on a stout scape. In the erect flower the small greenish calyx-lobes are reflexed, but the lanceolate white petals assume an horizontal position, and the 10 stamens in 2 rows are also directed laterally from the time on that they begin to shed their pollen. The upper portion of the ovary forms a disc-shaped nectary around the two styles, and nectar is secreted in abundance. These flowers are decidedly proterandrous, and in this respect they agree with the majority of the European species, very few of which are proterogynous. Dehiscence starts in the stamens belonging to the outer row, and a few days later those of the inner row become

*Classification and nomenclature according to "Britton's Manual of the Flora of the Northern States and Canada."

involved in the same process. At the beginning of this, the male stage of the flower's existence, the styles are very short, and the stigmas hardly noticeable. But the styles gradually rise above their surroundings, and after all the anthers have emptied their reddish-yellow pollen the small capitate stigmas become receptive. The female stage is therefore very plainly separated from the male stage, and in such a flower self-pollination is entirely out of the question. Cross-pollination is insured by the visits of numerous insects, and these obtain a bountiful supply of nectar and pollen. The individual flower is unsightly, but the grouping of such a large number as are usually present in the inflorescence of each plant renders the whole more or less attractive. Corresponding with the entirely exposed situation of the nectar we find these small flowers visited nearly exclusively by insects with short tongues. Several European species of *Saxifraga* are especially attractive to flies, but in our *S. Pennsylvanica* other short-tongued insects are just as well represented, and the small bees of the genus *Halictus* are always regular attendants. According to the list given below the flies and short-tongued bees together represent 64% of the entire number of visitors, and this agrees quite well with the figures obtained for other flowers with entirely exposed nectar.

A. Hymenoptera.

Apidæ: (1) *Apis mellifera* L., worker, s.; Andrenidæ: (2) *Andrena mariæ* Rob., female, s.; (3) *Halictus pilosus* Sm., female, s. and c. p.; (4) *H. zephyrus* Sm., female, s. and c. p.; (5) *H. sparsus* Rob., female, s. and c. p.; (6) *H. hortensis* Lov., female, s. and c. p.; (7) *H. anomalus* Rob., female, s. and c. p.; (8) *Sphecodes cressonii* Rob., female, s.; (9) *S. arvensis* Patton, female, s.; (10) *Prosopis pygmaea* Cr., male, s.; Eumenidæ: (11) *Odynerus philadelphiae* Sauss., s.; Crabronidæ: (12) *Crabro obscurus* Sm., s.; (13) *C. trifasciatus* Say, s.; (14) *Oxybelus 4-notatus* Say, s.; Ichneumonidæ: (15) *Ichneumon* sp., s.; (15) *Cryptus persimilis* Cr., s.; (17) *Cryptus* sp., s.; (18) *Chorinaeus carinatus* Cr., s.; Tenthredinidæ: (19) *Dolerus similis* Norton, s.; (20) *D. aprilis* Norton, s.

B. Diptera.

Stratiomyidæ: (21) *Odontomyia pubescens* Day; Syrphidæ: (22) *Paragus bicolor* Fab.; (23) *Platychirus quadratus* Say; (24) *Allograpta obliqua* Say; (25) *Mesogramma marginata* Say; (26) *Sphærophoria cylindrica* Say; (27) *Syritta pipiens* L.; Conopidæ (28) *Zodion fulvifrons* Say; Tachinidæ: (29) *Exorista confinis* Fall.; Sarcophagidæ: (30) *Sarcophaga heliciis* Town.; Muscidæ: (31) *Lucilia cæsar* L.; (32) *L. sylvarum* Meig.; Anthomyidæ (3) *Phorbia fusciceps* Zett.; (34) *Phorbia* sp.; (35) *Hydrotæa* sp.; Geomyzidæ: (36) *Agromyza æneiventris* Fall.—all s. or f. p.

C. Coleoptera.

Elateridæ: (37) *Glyphonyx recticollis* Say; Cerambycidæ: (38) *Acmæops bivittata* Say; Chrysomelidæ: (39) *Orsodachna atra* Ahr.—all s. or f. p.

Heuchera hispida Pursh. Rough Heuchera. Alum-root.

This plant is remarkable on account of the close relations existing between it and the bee *Colletes æstivalis* Patton. The latter is an oligotropic bee, collecting pollen from the flowers of some species of *Heuchera* only, and it has been observed by Patton (1) in Connecticut, on the flowers of *H. americana*, and by Robertson (2) in Southern Illinois, on *H. hispida*. Around Milwaukee it is a regular visitor of the latter species, and last year, on June 3, I also came across it at Eagle, Waukesha Co., Wis., where *H. hispida* occurs in great numbers along the railroad leading to Palmyra. In Illinois Roberson found the plant visited by this bee exclusively, but in our region bees of the

(1) W. H. Patton. Proc. Bost. Soc. Nat. Hist. XX, pp. 142-144 (1879).

(2) Chas. Robertson. Flowers and Insects. VIII. Bot. Gaz. XVII, pp. 178-179 (1892).

Chas. Robertson. Notes on Bees, etc. Trans. Am. Ent. Soc. XXII, p. 116 (1895).

genera *Halictus* and *Augochlora* also resort to these flowers in search of pollen, as shown by the heavy and very conspicuous load of brick-red pollen that they carry away. The earliest flowers of *Heuchera hispida* make their appearance several days ahead of their special pollinator *Colletes æstivalis*. In 1901, for example, the first flowers were noticed on June 7. On June 11 the females of *Halictus* and *Augochlora* were busy at these flowers, but of *Colletes* a single specimen was seen, a male flying around the flowers in search of the females, which had not arrived up to this time. Four days later, however, (at the time of my next visit) they were also present, sucking and collecting pollen. Judging from the description of the flowers as given by Robertson, those of our surroundings agree essentially with those from Southern Illinois. The inflorescence is a panicle containing numerous greenish tubular flowers, which have been observed in blossom from June 3 to July 2. Along its upper side the flower is longer than along the lower side; in other words, it is obliquely cut off, and the width of 4 mm. enables the visiting short-tongued bees to insert their heads into the tube in search of nectar at the bottom. The tube is 6 mm. long, and nectar is secreted in drops on the upper surface of the ovary and on the adjacent walls of the calyx. These flowers are proterogynous, but the upper anthers shed their pollen soon after the stigmas have become receptive. The two divergent styles, with their small stigmas, reach the mouth of the flower, but since the dehiscent anthers are situated 2 or 3 mm. beyond the mouth of the flower, spontaneous self-pollination can hardly be expected to take place in the nodding flower. As a rule, the flowers are visited early before their anthers begin to open, and this insures cross-pollination. The following bees were taken on the flowers:

Andrenidæ: (1) *Colletes æstivalis*, Patton, male and female, s. and c. p.; (2) *Halictus provancheri* D. T., female, s. and c. p.; (3) *H. zephyrus* Sm., female, s. and c. p.; (4) *H. hortensis* Lov., female, s. and c. p.; (5) *Augochlora confusa* Rob., female, s. and c. p.

***Mitella diphylla* L. Mitrewort.**

The small, white, cup-shaped flowers, blooming from about May 5 to June 15, are adapted to small-sized insects. Syrphid-flies and short-tongued bees are the principal visitors, and the smallest among these belonging to the fly-genus *Paragus*, and the bee-genus *Halictus* are the most frequent ones, as far as the number of individuals is concerned. The flowers are arranged in a terminal raceme on a scape that attains a length of 30 to 40 cm. At its entrance the flower is 2 mm. wide, its depth is the same, and the nectar-drops on the lower portion of the calyx-tube are easily reached by insects with very short mouth-parts. The small, triangular calyx-lobes are erect, while the much longer white petals, with their fringed appearance, are spread out laterally or reflexed, as in the older flower. There are 10 stamens, all of them arising at the same level from the wall of the calyx and converging towards the middle, thereby forming with their anthers a small circle below the mouth of the flower. The very short styles, with their stigmas, are situated somewhat below the anthers. In the opening flower the anthers are all nearer to the calyx-tube but as those of the 5 stamens that alternate with the petals begin to open, they move towards the middle, and later on the 5 remaining stamens undertake the same movements. Proterandry is present, but of short duration, since the stigmas reach maturity very soon after the first anthers have burst open. In view of the vertical position of the flower, spontaneous self-pollination by the falling of pollen can hardly be expected, at least not in the young flowers. But the styles increase in length and place the stigmas beneath the anthers, and in the older flower this kind of pollination may take place if pollination through insects has not been accomplished previously. The latter are mostly present to such an extent as to insure either cross or self-pollination. Pollen is transported by the mouth-parts of the visitors. When in search of nectar an insect has to insert its proboscis between the stigmas and the introrse anthers, whereby some of the pollen adheres to the sides of the proboscis and in this way may be brought in con-

tact with the stigmas of the same or of another flower. Following is a list of the bees and flies observed on the flowers:

A. Hymenoptera.

Apidæ: (1) *Ceratina dupla* Say., female, s.; Andrenidæ: (2) *Augochlora confusa* Rob., female, s.; (3) *Halictus quadrimaculatus* Rob., female, s. and c. p.; (4) *H. pilosus* Sm., female, s. and c. p.; (5) *H. albipennis* Rob., female, s. and c. p.; (6) *H. hortensis* Lov., female, s. and c. p.

B. Diptera.

Syrphidæ: (7) *Paragus bicolor* Fab.; (8) *Allograpta obliqua* Say.; (9) *Mesogramma marginata* Say.; (10) *Sphaerophoria cylindrica* Say — all s. or f. p.

FAM. GROSSULARIACEÆ.

Within the genus *Ribes* (currants and gooseberries) the species differ considerably in the structure of the flowers, and accordingly in their adaptation to insects, as has been shown by Hermann Mueller (3) for several species of Europe. The same is clearly illustrated by the 5 species of our region considered below. We have on one side the primitive and saucer-shaped flowers of *R. rubrum* receiving the attention of small and poorly adapted insects; on the other side, the campanulate flowers of *R. gracile* and *R. floridum* adapted to the largest among the specialized bees (the bumble bees), and between the two extremes we find *R. oxyacanthoides* and *R. Cynosbati*, adapted to bees in general.

They all bloom close together, as will be seen from the follow-

(3) H. Mueller. Weitere Beobachtungen, pp. 298-300. See also P. Knuth Handb. d. Blütenbiologie, Vol. II, p. 437.

ing dates, indicating the blooming periods of these species as observed around Milwaukee:

R. rubrum, April 24—May 27.

R. Cynosbati, May 2—May 29.

R. floridum, May 6—June 7.

R. gracile, May 6—May 25.

R. oxyacanthoides, May 9—June 16.

According to these observations, all of the species have their flowers open together between May 9 and 27.

***Ribes rubrum* L. Red currant.**

This plant is an inhabitant of damp woods, and is rapidly disappearing from the immediate surroundings of Milwaukee on account of the changed condition of most of the woods of our territory. It occurs also in Europe and Asia, and H. Mueller (4) has given an account of its pollination. The structure of the flower, as it occurs with us, does not quite agree with Mueller's description and the figure presented by Knuth (5). The flower of our region is purplish, has a diameter of about 6 mm., and is rather flat, with entirely exposed nectar like *R. alpinum* (6), while the European one is more campanulate, with slightly concealed nectar. From this we must conclude that the flower of the North American *R. rubrum* has remained nearer to the primitive type of the ancestral flower, while in Europe the flower has progressed in the direction of a campanulate flower. The same may be stated for the cultivated form, the red currant of our gardens.

There are 20 or more flowers in a drooping raceme. The stamens, with their introrse anthers, and the style with the greenish 2-parted stigma, are all of the same length, hardly reaching 1 mm. above the disc. The anthers and the stigma become mature at the same time (homogamy). Nectar appears as small drops on the

(4) H. Mueller. Die Befruchtung der Blumen durch Insekten, p. 95.

(5) P. Knuth. Handb. d. Blütenbiologie, Vol. II, part 1, p. 439.

(6) H. Mueller. Loc. cit., p. 94.

uneven purplish disc, and the flowers are slightly sweet-scented. Insects crawling around on them may effect either self or cross-pollination. Some of the flowers are directed upwards, while others assume a vertical position, and in the latter pollen may fall down on the stigma and cause spontaneous self-pollination. The only visitors I have been able to observe on the few plants met were with a small fly, *Themira putris* L., (family Sepsidæ), and a small parasitic wasp, *Orthocentrus nigricoxis* Prov., (Tryphoninæ).

***Ribes oxycanthoides* L.** Northern gooseberry.

In this species the greenish pendulous flower is campanulate. The different parts at the entrance, i. e., the calyx-lobes, petals, and long stamens are more or less divergent, and for this reason insects can easily gain access to the flower. The white petals are inserted near the upper margin of the calyx-tube, and in this region the latter measures 3 mm. across and is just as deep. The flowers are homogamous. From its middle on the style is divided into 2 long slender branches, and these gradually become divergent, and carry the stigmas a short distance past the anthers. There is hardly any possibility of the latter coming in contact with the stigmas, but spontaneous self-pollination due to the falling of pollen may take place in the drooping flower. Nectar is present at the bottom, and is to some extent hidden from view and protected by hairs on the lower part of the calyx-tube and the style. In some flowers round openings may be noticed in the wall of the calyx-tube near its base, and these are made by ants, and enable the latter to steal nectar from the outside instead of proceeding along the natural route which is protected by hairs. The structure of these flowers and their pendulous position point to an adaptation to bees, and 7 of the 9 visitors figuring in the following list are bees:

A. Hymenoptera.

Apidæ: (1) *Bombus consimilis* Cr., female, s.; (2) *B. affinis* Cr., female, s.; (3) *B. ternarius* Say., female, s.;

Andrenidæ: (4) *Andrena milwaukeeensis* Graen., female, s.; (5) *A. vicina* Sm., female, s.; (6) *Halictus coriaceus* Sm., female, s. and c. p.; (7) *H. forbesii* Rob., female, s. and c. p.; Eumenidæ: (8) *Eumenes fraternus* Say, s.

B. Diptera.

Syrphidæ: (9) *McInostoma obscurum* Say., f. p.

Ribes Cynosbati L. Wild gooseberry.

There are usually 3 of the greenish campanulate flowers forming a small raceme only 3 cm. in length. The calyx-lobes are entirely reflexed, but the much smaller white petals are erect. At its entrance the flower has a diameter of 3 mm., it widens out somewhat below, and has a depth of 4 mm. The stamens arise from the calyx-tube a short distance below the petals and converge towards the style. The anthers form a ring around the style about $1\frac{1}{2}$ mm. beyond the mouth of the flower, and, as a rule, the dark-green two-parted stigma surpasses the white anthers by at least 1 mm. But the style shows a tendency to variation, and in some plants the stigma hardly surpasses the anthers at all, thereby favoring spontaneous self-pollination in these homogamous flowers. Nectar is present at the bottom of the tube, a sweet odor is noticeable, and the laterally directed flowers are well visited by insects, mostly bees. Numerous hairs arising from the inner wall of the calyx-tube, as also from the style, serve to protect the nectar from unwelcome visitors, but so far as ants are concerned, I have on several occasions seen specimens of *Cremastogaster lineolata* (Say) Emery and *Formica fusca* L. var. *subsericea* (Say) Emery force their way down to the nectar. Not rarely these ants also gain an entrance to the flower by biting a piece out of the calyx-wall, and Trelease (7) has seen the white-faced hornet (*Vespa maculata* L.) perforating these flowers in the same manner; although on other occasions he witnessed this insect

(7) Wm. Trelease. Note on the Perforation of Flowers. Bull. Torr. Bot. Club, VIII, pp. 68-69 (1881).

visiting the flowers in a legitimate way. The following insects were seen on the flowers:

A. Hymenoptera.

Apidæ: (1) *Apis mellifera* L., worker, s.; (2) *Bombus virginicus* Oliv., female, s.; (3) *B. americanorum* Fabr., female, s.; (4) *B. separatus* Cr., female, s.; (5) *B. ternarius*, Say., female, s.; Andrenidæ: (6) *Andrena milwaukeeensis* Graen., female, s. and c. p.; (7) *A. vicina* Sm., female, s. and c. p.; (8) *A. nivalis* Sm., female, s. and c. p.; (9) *A. dubia* Rob., male, s.; (10) *Halictus lerouxii* Lep., female, s.; Vespidae: (11) *Vespa germanica* Fabr., s.

B. Diptera.

Syrphidæ: (12) *Pipiza femoralis* Lw.; (13) *Syrphus americanus* Wied. — all s. or f. p.

Ribes gracile Michx. Slender gooseberry.

Robertson (8) has made us acquainted with the mode of pollination of this species. In the slender, pendulous flower, the calyx-lobes are reflexed, and together with the petals, they serve as footholds for the visiting bees. The converging stamens are rather long, and extend in the flowers of our region about 11 mm. beyond the calyx-tube. The latter is 3 mm. deep. By pressing up against the filaments, the erect petals, which are only 2 mm. long, form a tube which practically constitutes an elongation of the calyx-tube. In order to reach the nectar at the bottom of the flower, the insect must have a proboscis of at least 4 mm. length. This is inserted through one of the openings between two filaments and the top of a petal. In this species, as in the two preceding ones, there are numerous hairs at the bottom of the tube.

In these flowers we are dealing with proterandry. When the first anthers dehisce the stigma is still 4 mm. below the anthers (above in the pendulous flower), but on account of a gradual

(8) Chas. Robertson. *Flowers and Insects*. IX. Bot. Gaz. XVII, pp. 270-271 (1892).

lengthening of the style, the stigma surpasses the anthers before it becomes receptive. Pollination is generally due to insects and the flowers are, as Robertson states, adapted to bumble bee females. the only sex of bumble bees represented so early in the year. On account of their size, they are the only bees which, while hanging on to the flowers, are capable of sucking, and at the same time touching the anthers and stigma. These parts of the flower come in contact with the ventral surface of the base of the abdomen. Robertson observed 4 species of bumble bees, and in addition to these, 18 smaller bees which he regards as intruders, for the reasons set forth above. But in several instances I have seen some of the smaller bees (species of *Andrena*) visiting the flowers for nectar, and besides crawling to the top of the flower for the purpose of collecting pollen. Such visits of the smaller bees are of course of as much importance to the flower as the visits of bumblebees, although these flowers are undoubtedly adapted to the latter. The exceptional visits of flies to such a flower are of little significance. At Milwaukee I have seen the following insects as visitors:

A. Hymenoptera.

Apidæ: (1) *Bombus americanorum* Fabr., female, s.; (2) *B. consimilis* Cr., female, s.; (3) *Nomada cressonii* Rob., female, s.; (4) *Ceratina dupla*, Say, male, s.; Andrenidæ: (5) *Andrena nivalis* Sm., female s. and c. p.; (6) *A. milwaukeeensis* Graen., female, s. and c. p.; (7) *A. cressonii*, Rob., female, s. and c. p.; (8) *Augochlora confusa* Rob., female, s.; (9) *Halictus leucorhynchus* Lep., female, s.; (10) *H. provancheri*, D. T., female, s.; (11) *H. quadrimaculatus* Rob., female, s.; (12) *H. connexus* Cr., female, s.; (13) *H. albipennis* Rob., female, s.; (14) *Sphecodes clematidis* Rob., female, s.; Eumenidæ: (15) *Odynerus philadelphiae* Saus, s.

B. Diptera.

Syrphidæ: (16) *Syrphus americanus* Wied., f. p.

C. Lepidoptera.

Sphingidæ: (17) *Hemaris diffinis* Bsdv., s.

Ribes floridum L'Her. Wild black currant.

When visiting the yellowish-green pendulous flowers of this species, the bees hold on to the reflexed calyx-lobes the same as in the case of *R. gracile*. The white, erect petals form together with the slightly shorter stamens, a tube of 3 mm. length on top of the calyx-tube, which is 4 mm. long. The whole tube is, therefore, 7 mm. long; it has a diameter of 3 mm. at its entrance, and widens out to 4 mm. lower down. The anthers are situated just inside of the mouth of the flower, but the two-parted stigma protrudes slightly. Anthers and stigma reach maturity together, and spontaneous self-pollination is very apt to take place on account of the falling of the pollen. There is a free supply of nectar at the bottom of the flower, but no protecting hairs are present as in the three preceding species with campanulate flowers. These flowers are adapted to bumble bees, but smaller bees also pay their attention to them on account of the pollen near the mouth of the flower. Any of these bees may be instrumental in effecting either self or cross-pollination, but the latter is favored by the advanced position of the stigma. Bees, the names of which I herewith present, were the only visitors witnessed on the flowers:

Apidæ: (1) *Bombus pennsylvanicus* Deg., female, s.; (2) *B. separatus* Cr., female, s.; Andrenidæ: (3) *Andrena nivalis* Sm., female, c. p.; (4) *Halictus coriaceus* Sm., female, c. p.; (5) *H. forbesii* Rob., female, c. p.; (6) *H. versatus* Rob., female, c. p.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. IV.

BY CHARLES THOMAS BRUES.

A very interesting lot of small Hymenoptera collected by Mr. Charles Schaeffer, of the Museum of the Brooklyn Academy of Arts and Sciences, have furnished most of the material contained in the following pages.

They were collected principally in the Southwest, and were kindly sent to me by Mr. Schaeffer for examination. The types of these species are in the Brooklyn Museum, those of the others in the Milwaukee Public Museum.

FAMILY BETHYLIDÆ.

Epyris Westwood.

A considerable number of species of this large cosmopolitan genus have been described from the United States. Some of them are very closely allied, but the following table will aid in their identification.

Kieffer includes in *Epyris* all species previously put into *Mesitius* by Ashmead and others, restricting *Mesitius* to certain forms not occurring in our fauna. I have followed his arrangement, and our species heretofore placed in this latter genus will be found in the table:

1. Scutellum with two distinctly separated foveæ at the base.... 2
 Scutellum with a broad transverse impressed line at the base,
 or at least a narrow one connecting two foveæ..... 16
 Scutellum without either groove or foveæ; black, legs and
 antennæ brown, wings brownish.....**reticulatus** Kieffer.
2. Wings fully developed..... 3
 Wings short, reaching to only a little beyond the base of the
 abdomen; legs rufous, metanotum with a faint median
 carina**brachypterus** Ashmead.

3. Body entirely black..... 5
 Body pale, or the tip of the abdomen conspicuously red..... 4
4. Brownish-testaceous, head piceous, antennæ and legs honey
 yellow*flaviventris* Kieffer.
 Only the tip of the abdomen reddish.....*texanus* Ashmead.
5. Metanotum with a median raised longitudinal line or carina
 which extends to the tip, and often with shorter basal ones
 on each side..... 6
 Metanotum without a median carina except toward the base,
 four anterior tibiæ and all tarsi rufous.....*indivisus* Kieffer.
6. Wings hyaline or nearly so..... 7
 Wings distinctly subfuscous..... 15
7. Metanotum with only a single median carina, aside from the
 lateral raised margins..... 8
 Metanotum with additional longitudinal carinæ on each side
 of the median one toward the base..... 11
8. Pronotum twice as long as the mesonotum..... 9
 Pronotum at most one-third longer than the mesonotum.... 10
9. Eyes bare, femora black.....*clarimontis* Kieffer.
 Eyes hairy, legs entirely reddish.....*longicollis* Kieffer.
10. Head above finely punctate.....*nudicornis* Kieffer.
 Head above impunctate.....*erigoni* Kieffer.
11. Legs in part black, at least some of the coxæ..... 12
 Legs including coxæ pale rufous or pale honey-yellow, meta-
 thorax with about seven raised lines, the lateral ones abbrev-
 viated*bifoveolatus* Ashmead.
12. Legs entirely black, the tibiæ and tarsi brownish pubescent.
monticola Ashmead.
 Legs not entirely black..... 13
13. Prothorax twice as long as the mesonotum; legs rufous, coxæ
 and anterior femora black, middle and posterior femora
 fuscous*minutus* Ashmead.
 Prothorax at least three times as long as the mesonotum.... 14
14. Head one-half longer than broad, joints 2-5 of the flagellum
 one half as long as thick.....*californicus* Ashmead.
 Head scarcely longer than wide, joints 2-5 of flagellum quad-
 rate*myrmecophilus* Brues.

15. Mandibles with only a large outer tooth, the inner margin scarcely denticulate, femora distinctly reddish.
nevadensis Ashmead.
Mandibles with inner denticulations besides the large outer tooth, all the femora black.....*vancouverensis* Ashmead.
16. Wings well-developed 17
Wings very small, reaching only to the tip of the metathorax; legs including coxæ rufo-ferruginous; head nearly twice as long as wide.....*subapterus* Melander and Brues.
17. Head and thorax metallic green, abdomen black, with ferruginous tip 18
Body black, sometimes æneous, especially the head..... 19
18. Head and thorax bright golden green, posterior face of metanotum polished, with a median raised line..*fulgens* sp. nov.
• Head and thorax dark metallic green, posterior face of metanotum transversely aciculated.....*analis* Cresson.
19. Four posterior coxæ and legs pale or rufous..... 20
All coxæ black..... 24
20. Head black or bluish, not at all metallic..... 21
Head æneous, abdomen bluish-black, wings fuscous.
æneiceps Ashmead.
21. Head very large, broader than the thorax and strongly punctured*megacephalus* Ashmead.
Head normal 22
22. Head and thorax bluish, transverse median nervure in wing giving out a spurious vein toward the disk of the wing.
grandis Ashmead.
Head and thorax black..... 23
23. Mesopleura foveated, mandibles 5-dentate.....*rufipes* Say.
Mesopleura areolated, mandibles 6-dentate..*columbianus* Ashmead.
24. Metathorax with five raised longitudinal lines..... 25
Metathorax with only one distinct delicate raised longitudinal line*carbonarius* Ashmead.
25. Wings sub-hyaline, abdomen entirely black..*occidentalis* Ashmead.
Wings sub-fuscous, abdomen red at the tip.
hæmorrhoidalis Kieffer.*

*This is placed by Kieffer (Archiv f. Zool. I, 528 (1904), in his genus *Rhabdepyris*, characterized by simple tarsal claws, but this species as well as others later placed by him in *Rhabdepyris* have bifid claws. I have therefore included it provisionally in *Epyris*.

Epyris fulgens sp. nov.

Female. Length 7 mm. Head, thorax, and scutellum brilliant metallic green, metanotum purplish; abdomen black, with the tip of the fourth and all the following segments rufo-ferruginous. Legs except anterior coxæ and base of posterior pair ferruginous. Legs and antennæ, except second joint, rufous. Head as long as wide, polished, not shagreened, but covered with very sparse distinct punctures, without any median groove on the front. Eyes bare, separated by one-third their length from the posterior margin of the head. Malar space short. Antennal scape much swollen apically and bent, as long as the three following joints together; pedicel and second flagellar joints of equal length, the first flagellar joint only one-half as long; following gradually increasing, the fifth quadrate. Pronotum punctured like the head, rounded in front and on the sides, without any lateral or anterior carinæ. Mesonotum and scutellum smooth, with scarcely any punctures; the parapsidal furrows complete, but stronger behind; lateral furrows strongly convergent anteriorly, but not extending much more than halfway toward the anterior margin. Scutellum with a narrow straight basal groove connecting the two basal foveæ. Metanotum quadrate, with five longitudinal carinæ that extend to the posterior margin; between them the surface is transversely rugulose and on the sides microscopically transversely aciculated. Sides and posterior edges with a submarginal ridged groove like those between the discal carinæ. Posterior face polished, divided by a median line. Abdomen considerably shorter than the thorax, polished except for delicate scattered punctures on the anterior half of the apical segments. Venter with the posterior parts of the apical segments finely punctured. Legs stout, incrassated, middle and posterior tibiæ strongly spinulose. Tarsal claws with a single tooth within, the anterior metatarsus a little longer than the three following joints. Mesopleuræ polished, with a few punctures, below with a grooved line, and behind with an arcuate elongate fovea; above with a shallow oval fovea. Metapleuræ shagreened. Wings sub-hyaline, the anterior part distinctly infuscated. Stigma quadrate, postmarginal vein wanting, radial one-half as long as the basal, which is a little shorter than the strongly arcuate transverse median.

Described from one female collected by Mr. Schaeffer at Esperanza Ranch, Brownsville, Texas, August 4.

This resembles *E. aurichalceus* Westwood, from the West Indies, but this species as identified by Kieffer (Bull. Soc. Hist. Nat. Metz., XII (2 Ser.) 1905, p. 12), belongs to *Anisepyrus*, in which the pronotum is margined anteriorly. It differs also by the entire lateral carinæ of the metanotum. From the South American *E. planiceps* Fabr., it differs by its lighter color, more evenly darkened wings and purplish metanotum, and from *E. analis* Cress. by the brighter color and different sculpture of the posterior face of the metanotum.

It is the most handsome species yet to be discovered in our fauna.

***Parasierola bicarinata* sp. nov.**

Female. Length 3.5 mm. Shining black; mandibles, antennæ, coxæ and legs yellowish ferruginous. Head as high as broad, finely shagreened and covered with large thimble-like punctures that are separated by about twice their width. Front below with a median carina which reaches up as far as the middle of the eye and is continued onward about the ocelli as a widening polished strip. Eyes oval, bare, separated by one-half their length from the occiput. Head behind sculptured as in front. Projecting lobe of clypeus rounded, honey-yellow; mandibles with four teeth, of which the outer one is considerably the largest. Antennæ reaching to the tip of the pronotum, slender, 13-jointed, attenuated at the tips. Scape rather slender, as long as the first two flagellar joints together; pedicel and first two flagellar joints of about equal length, from thence the joints become shorter and narrower, the apical six joints being moniliform. The basal flagellar joints are scarcely longer than wide. Prothorax about as wide as long, shagreened and punctured like the head. Mesonotum about as long as the pronotum and similarly sculptured, without any trace of furrows except posteriorly very near the lateral margins, which evidently correspond to the outer pair of furrows seen in some genera. Scutellum rounded-triangular, two-thirds as long as the mesonotum, with a broad transverse groove at the base which is widened to form a rather distinct fovea on each side; its posterior edge with a series of about six large punctures. Metathorax quadrate, finely sculptured, with a smooth space medially in front that bears a pair of nearly confluent foveæ and with a carina on each side one-half way to the margin; its posterior face margined above and on the

sides. Abdomen oval, shining black. Legs stout, tarsal claws with a large triangular pointed tooth at the base which is very large and longer than the claw. Wings faintly tinged with fuscous; stigmata piceous; veins fuscous; radial vein reaching nearly half-way from the stigma to the wing tip; basal nervure broken at the middle, the closed discoidal cell as large as the stigma, its cubital side the shortest.

Brownsville, Texas. Mr. Schaeffer.

This form is related to *P. flavicoxis* Kieffer, from Nicaragua, but the mandibles are quadridentate and there is a longitudinal discal carina on each side of the median smooth space on the metanotum. It differs from *P. cellularis* Say, by the much shorter pronotum, as I have identified Say's species. It is evident, however, that what Kieffer redescribed as *cellularis* (Berliner Entom. Zeitschr, L., p. 254 (1905) is still another species different from the one here described.

***Chelognus schaefferi* sp. nov.**

Female. Length 5 mm. Black; base of antennæ, mandibles and clypeus yellowish; prothorax, four anterior legs and the coxæ and basal parts of the femora of the posterior pair bright ferruginous. Head not quite twice as wide as thick, the vertex distinctly convex. Antennæ 10-jointed, the scape distinctly shorter than the first flagellar joint, which is twice as long as the pedicel, but distinctly shorter than the second and third together. Scape, pedicel and first two flagellar joints ferruginous, following black, the black joints being distinctly thickened. Front and vertex rugulose. Face and clypeus with a fine median keel between the antennæ. Mandibles pale yellowish, with black teeth. Head behind and cheeks rugulose, not at all striate below, palpi black. Prothorax bright ferruginous, smooth and polished, with scattered punctures; as long as the mesonotum and scutellum together. Remainder of thorax black, mesonotum and scutellum shining and with very sparse punctures. Mesonotum with four furrows; scutellum with a transverse crenulate impressed line at its base, and another simple one separating it from postscutellum. Metathorax rugulose, its posterior face nearly smooth above and faintly transversely aciculate below. Pleuræ rugulose. Abdomen entirely shining bluish black. Chela of anterior tarsus reaching nearly to the base of the second tarsal joint, whitish, dark at the tip, somewhat curved, especially at

the base. Posterior legs, except coxæ and base of femora, black, the tarsal joints each tipped with yellowish. Body everywhere except the flagellum of the antennæ conspicuously whitish pubescent. Wings with the usual two fuscous bands, which are very strong. Stigma lanceolate, pale at the base and piceous at the tip. Veins fuscous, except the submarginal, median and anal veins, which are pale yellow.

One female from the Huachuca Mountains, Arizona, collected by Mr. Schaeffer.

This species resembles *C. atriceps* Brues, a species occurring in the Northeastern United States, but the typical form differs conspicuously by the black metathorax, scutellum and mesothorax. The head behind is also much more coarsely sculptured, while the punctures of the prothorax are sparse. The first flagellar joint is shorter, being but little longer than the scape, while in *atriceps* it is nearly twice the length of the scape.

Var. a. Colored like *C. atriceps*, with the entire thorax reddish, but having the structural characters of the type. One female from Brownsville, Texas.

FAMILY SCELIONIDÆ.

Hoplogryon grandis sp. nov.

Female. Length 2 mm. Brownish-yellow; head, abdomen and antennal club black. Head two and one-half times as wide as thick, shining black; front smooth, with a median line extending from the anterior ocellus to the antennæ, the anterior orbits, cheeks and face below strongly vertically striated. Vertex irregularly rugose. Mandibles strongly curved, yellow, with two long, equal brown teeth. Mesonotum and scutellum very coarsely and almost confluent punctate; no parapsidal furrows; ferruginous, with a large orbicular spot which reaches nearly to the scutellum. Scutellum black, postscutellum ferruginous, with a long sharp spine. Metathorax ferruginous, with the lateral angles very acutely produced to form long spine-like teeth; its posterior face irregularly rugulose, truncate or slightly concave. Abdomen ovate, convex; shining black, the first segment brown, as long as broad at the tip and roughly striated; second segment sculp-

tured like the first, two and one-half times as wide at the base as it is long. Third segment occupying two-thirds of the remaining surface, smooth and shining, with a few scattered punctures. Legs, including coxæ, yellow, the pleura with a dark spot just above the posterior coxæ. Wings very short, ciliated, reaching only to the tip of the first abdominal segment. Antennæ 12-jointed, bright yellow, with the apical eight joints black. Scape slender, three-fifths the length of the flagellum; first and second flagellar joints subequal, each twice as long as thick and considerably longer and thicker than the pedicel; third and fourth short, moniliform or quadrate, forming the base of an unusually slender club; seventh flagellar joint the shortest, twice as broad as long and twice as thick as the second flagellar joint.

One specimen, Cold Spring Harbor, Long Island, New York.

This is a large and prettily marked species, distinguished at once by its large size, vestigial wings, and acutely toothed lateral metathoracic angles.

FAMILY EURYTOMIDÆ.

Chryseida inopinata sp. nov.

Female. Length 5.5 mm. Metallic green, the abdomen more or less blue. Femora reddish, tarsi whitish; antennæ ferruginous or rufous. Head two and one-half times as wide as thick, coarsely confluent punctate. Antennæ inserted at the middle of the face; their cavity transversely rugose, narrowed above and enclosing the anterior ocellus; lateral ocelli set in large foveæ near the eyes. The punctures of the row along the anterior margin of the eyes are elongated, giving the groove a transversely rugose sculpture; medially the groove is margined by a very sharp carina. Cheeks margined behind; mandibles rufous. Eyes oval, reddish, microscopically pubescent; a little longer than the malar space. Antennæ with only nine visible joints. Scape slender, but little longer than the first flagellar joint. Pedicel very small, rounded, only one visible ring-joint. Flagellum slightly clavate apically, the first joint one-half longer than the second which is two times as long as thick; third, fourth and fifth smaller; sixth oval, one-third longer than the fifth. Prothorax nearly three times as wide as long, sculptured like the head, as are also the mesonotum and scutellum,

the punctation becoming coarser posteriorly. Mesonotum scarcely longer than the pronotum; scutellum half longer than the mesonotum. Metathorax excavated behind, the cavity coppery, faintly aciculated medially and punctate around the sides. Metapleuræ purplish blue, coarsely punctate. Abdomen ovate, more or less compressed especially at the tip; sixth segment carinate above; fourth segment longest. All coxæ green; femora bluish, the hind pair reddish; base and tips of tibiæ and tarsi except last joint whitish, the tibiæ medially rufous. The legs are all rather stout, but the femora are not particularly thickened. The body is more or less sparsely whitish hairy, and the fourth, fifth and sixth segments each bear a well marked spot of white pubescence on each side. Wings with a brown cloud that extends entirely across the wing, although it is stronger in front where it extends apically a short distance along the costa beyond the postmarginal vein. Marginal vein four or five times as long as thick; postmarginal a trifle longer and the stigmal two-thirds as long, knobbed.

One female from Brownsville, Texas. Mr. Schaeffer.

This is the first representative of this handsome and attractive genus to be found in North America, other species being known only from Tropical South America and the Island of Grenada, in the Caribbean Sea.

The occurrence of this, together with the other Chalcidid genera *Kapala*, *Schizaspidia* and *Chalcedectes*, is extremely interesting and serves to emphasize the truly neotropical character of the fauna in this part of Texas. All these genera occur commonly in Brazil, where they reach their highest development. *Kapala* is also represented by a species from southern Florida, but none of the others have hitherto been found within our faunal limits.

FAMILY EUCHARIDÆ.

Schizaspidia septentrionalis sp. nov.

Female. Length 7 mm. Black, marked with luteous or testaceous; legs pale testaceous. Head black, twice as wide as high, coarsely striate, the striæ vertical on the sides of the face above, but curving in

transversely to the median line below the antennæ. Lower half of the sides of the face cross-striated. Clypeus smooth, occiput cheeks and malar space finely striated. Malar space distinctly longer than the eye-height. Mandibles falcate; testaceous, with long sharp tips and no teeth within. Antennæ 11-jointed, reaching as far as the tip of the scutellum; scape and ring-joint yellow; flagellum black, except the apical four joints, which are fuscous. First flagellar joint three times as long as the scape and more than twice as long as the second; following joints growing shorter, the seventh twice as long as thick. Prothorax entirely pale testaceous. Mesonotum pale testaceous, with a large median horseshoe-shaped spot, a large oval spot on each of the parapsides, basal half of axillæ, narrowed medially and connected with a median scutellar stripe that includes the scutellar teeth, also black. The entire surface of the thorax is coarsely reticulately punctate with the sutures crenulate. Scutellum triangular, with two blunt divergent teeth at the apex; it is as long as the mesonotum medially. Metathorax deeply constricted at the base and bilobate behind, but without teeth or sharp protuberances; more or less black on the sides and with a dark line above. Propleuræ entirely pale testaceous; mesopleuræ with three confluent testaceous spots above, the second of which extends farther down. Legs and abdominal petiole pale testaceous, slender, the latter as long as the posterior femora. Coxæ blackened at the extreme base, and last tarsal joint piceous. Abdomen as high as the thorax and one-half as long, squarely truncate at the base; polished black, the second segment concealing all the following ones. It is black, with a large honey-yellow crescentic mark on each side. Ovipositor very minute. Wings hyaline, tinged with yellow; marginal vein long, two-thirds the length of the submarginal; stigmal quadrate, sessile; postmarginal very short.

One specimen from the Huachuca Mountains, Arizona.

This is the first member of this genus to be discovered in North America although two species are known from Brazil.

***Kapala furcata* Fabr.**

Mr. Schaeffer sent me a number of specimens of this beautiful Eucharid from Brownsville, Texas. The species occurs in Brazil, and has also been found in Grenada, but I believe that this is the first time that it has been recorded from so far north as the United

States. Quite recently Kieffer* has redescribed the species, but he does not mention any locality.

The Brownsville specimens have the scutellar processes more approximated at the tips, but otherwise they agree well with Kieffer's description, and also with Lepeletier's figure, published in his *Histoire Naturelle des Insectes Hymenoptères* (Pl. 38, fig. 5. The species is also figured in the *Biologia* by Cameron.†

FAMILY CLEONYMIDÆ.

Chalcedectes texanus sp. nov.

Male. Length 7 mm. Bluish-metallic, with reddish cupreous reflections. Abdomen æneous, hind femora more or less purplish; base of all tarsi pale. Head very strongly transverse, four times as wide as thick; seen from the front as wide as high; its color greenish, the antennal depression purple; surface whitish-hairy and closely, coarsely punctate, but not confluent so. Occiput but faintly punctulate; mandibles piceous, tridentate. Palpi piceous, the apical joint of the maxillary pair long and suddenly swollen at the base, apical joint of the labial pair triangular and flattened. Antennæ black, the flagellum one-half longer than the scape; first flagellar joint equal to the ring-joint and pedicel together; second, third and fourth decreasing; fifth and sixth quadrate; seventh transverse; eighth obliquely truncate. Malar space with a furrow, its height two-thirds the length of the eye. Thorax somewhat more coarsely punctured than the head; middle lobe and scutellum greenish-violet, the parapsides behind blue; prothorax blue in front and greenish on the sides. Metanotum reticulate medially and smooth on the sides, where there is a large distinct patch of white pubescence. Pleuræ variegated in color, coarsely punctate except for the smooth posterior side of the mesopleural and the finely arcuately aciculated propleural furrow. Abdomen narrowly ovate, shining greenish-black; margin of the first segment notched medially, the others entire; second, third and fourth segments short, the fifth long. Legs cupreous, the reddish tint very pronounced. Posterior femora twice as long as thick, with four long teeth below, and another

*Berliner Entom. Zeitschr. LXIX, p. 243 (1904).

†Biol. Centr.-Amer. Hymenoptera, Pl. 5, fig. 17.

broad quadridentate one near the apex, the apical denticles of which are smaller. Hind tibiae reddish at the base; first joint of all the tarsi whitish, the second brown and the rest piceus. Wings hyaline, the marginal vein two-thirds as long as the submarginal and four times as long as the stigmal. Postmarginal fully as long as the marginal.

Described from one specimen collected by Mr. Schaeffer at Brownsville, Texas.

This is the first species of *Chalcedectes* to be discovered outside of the South American fauna.

There is also a male of a second species from Brownsville, but it is too poorly preserved for description.

FAMILY ENCYRTIDÆ.

Anastatus laticeps sp. nov.

Female. Length 4.5 mm. Rufo-ferruginous varied with black. Entire body clothed with sparse glistening pubescence. Head flat, nearly four times as wide as thick; viewed from in front the eyes reach distinctly below the middle, being two-thirds as long as the head-height; above the eyes are close together so that the lateral ocelli are nearer to the eye-margin than to the median ocellus. Cheeks long, malar furrow distinct, eyes distinctly hairy. Antennæ long and slender, the scape pale rufous, black at tip and reaching to the anterior ocellus. Flagellum imperceptibly thickened apically, black, twice as long as the scape; pedicel and first flagellar joint nearly equal; second a little longer, following decreasing in length until the ones near the tip are nearly quadrate. Surface of head microscopically rugulose, with a metallic reflection in certain lights. Front very slightly and broadly excavated. Antennæ inserted just below the base of the eyes. Palpi blackish toward the tip, the apical joint slender, rounded at the tip. Prothorax very short. Mesonotum with the parapsidal depressions meeting behind the middle and continuing as a median depression to the hind margin; the elevations sharp on the posterior third, then becoming very weak and broadly rounded. Scutellum very strongly convex, almost pyramidal anteriorly, with a wide base on the mesonotum, clothed with a few scattered black hairs and bearing

a median row of more or less bristle-like ones anteriorly. Metathorax exceedingly short. The thorax is brownish-yellow, the mesonotum with a greenish reflection that conceals the brown; metathorax brown and mesopleura with a green stripe. Abdomen as long as the head and thorax, greenish-black, the venter brownish at the base. Posterior margins of all the segments entire, the basal segments smooth and shining, but the apical ones becoming very distinctly punctate. Venter smooth. Ovipositor pale yellow, distinctly longer than the abdomen. Legs brown, middle tibiae, posterior femora and tibiae and metatarsi greenish-piceous; posterior coxae green black. The posterior tibiae are distinctly compressed, with a whitish line externally; middle tarsi except the last joint and the hind tarsi, except the first and last joints, whitish. Wings hyaline, with a dark gray transverse band embracing the marginal and stigmal veins. Marginal vein as long as the submarginal and about four times as long as the short, very oblique and slightly knobbed stigmal. Postmarginal a little shorter than the stigmal.

Described from one female from Esperanza Ranch, Brownsville, Texas.

This is a close relative of the following species.

***Anastatus longiceps* sp. nov.**

Female. Length 4.25 mm. Ovipositor 1 mm. Rufo-ferruginous, abdomen black toward the tip. Head transverse, seen from above three times as wide as thick and distinctly longer than high. The eyes do not reach below the middle of the head so that the malar space is as long as the eye. Eyes widely separated above; the lateral ocelli as far from the eye-margin as from the anterior ocellus. Eyes faintly hairy. Head microscopically rugulose, the front scarcely impressed. Antennae inserted considerably below the level of the lower eye-margin. Antennal scape reaching to the anterior ocellus, slender, rufous; flagellum black, scarcely thickened apically. Pedicel and first flagellar joint of equal length, the following joints shorter, the subapical ones, however, longer than wide. Malar furrow distinct. Palpi black toward the tip, the apical joint swollen and obliquely truncate at the apex. Mesonotum short, the furrows very distinct anteriorly, forming a wide median depression behind the middle. Parapsidal elevations sharp posteriorly, rising to the posterior third, then suddenly declivous and rounding off anteriorly. Scutellum with a wide base against the

mesonotum; slightly convex, sparsely covered with black hairs, but without a median row. Metathorax one-half as long as the scutellum. The thorax is entirely rufo-ferruginous except for greenish reflections on the mesonotum behind. Abdomen almost as long as the head and thorax, shining basally and finely but closely punctate apically; first three segments pale brown, with greenish reflections, apical segments greenish black. Ovipositor pale, one-half as long as the abdomen. Legs pale rufous, the middle tarsi brown, and the entire hind legs piceous brown with greenish reflections. Hind tibiae not at all compressed. Wings hyaline, with a broad brown cross-band which includes the marginal and stigmal veins. Marginal vein as long as the submarginal and five times as long as the stigmal, which is indistinctly knobbed.

One female from Brownsville, Texas. April.

This species is superficially extremely similar to the preceding, both in color and wing pattern. It is readily distinguished, however, by the shorter, more widely separated eyes, flat scutellum and non-compressed hind tibiae.

FAMILY MYMARIDÆ.

Gonatocerus americanus sp. nov.

Female. Length .75 mm. Shining black, the anterior knees and all tarsi light yellowish; scape and pedicel of antennæ more or less pale. Head large and flattened, very wide, nearly one-half wider than the thorax. Antennæ 11-jointed, slender, especially toward the base of the flagellum. Scape extending to the vertex, about five times as long as thick; pedicel oval, as stout as the scape. First three flagellar joints very small, together only a little longer than the pedicel; fourth longer but slender; fifth and sixth stouter, about equal; seventh and eighth longer; last joint nearly as long as the four preceding taken together, but no thicker. Mouthparts piceous brown. Thorax smooth and shining, the scutellum distinctly longer but considerably narrower than the mesonotum. Metathorax very short, depressed. Abdomen small, as long as the thorax, but only about one-half as wide as long; somewhat concave and compressed above. Legs slender, the tarsi five-jointed. Wings hyaline, broad, being only three times as long as

broad. Marginal vein short, extending to one-third the length of the wing. Wings with short cilia, the longest ones less than one-third the greatest breadth of the wing.

Milwaukee, Wisconsin, June 8, 1906. This seems to be the first species of *Gonatocerus* to be described from this country, although it is probable that a number occur here.

FAMILY BRACONIDÆ.

(?) *Pambolus dispar* sp. nov.

Female. Length 3 mm. Subapterous. Rufo-ferruginous, abdomen varied with darker and pale spots. Legs testaceous. Head rufous, distinctly wider than long, the temples full, but strongly rounded and narrowed behind; its surface smooth and shining. Posterior margin of the head very distinct. Seen from the side the head is as high as thick. Antennæ 18-jointed, ferruginous, a little shorter than the body. First flagellar joint as long as the scape, second and third shorter, the second two-thirds as long as the first. Apical four or five joints submoniliform. Thorax slender, narrower than the head and three and one-half times as long as wide; ferruginous, the small wing pads reaching barely beyond the tip of the metathorax. They are laceolate in shape and clothed with long whitish hairs. Pro- and mesothorax shining, the former with some coarse punctate sculpture laterally behind, and the latter with irregularly marked parapsidal furrows that coalesce before the scutellum. Scutellum triangular, with a deep broad fovea at its base, divided by several raised cross-lines. Metathorax cylindrical, truncate, its surface roughly reticulate. Abdomen broad, oval, as long as the head and thorax together. First segment longer than wide, and two times as wide at the tip as at the base, laterally with strong carinæ, its surface rugulose, with indications of two weaker central longitudinal carinæ that unite before the tip of the segment. Second segment large, as long as wide, shining and microscopically punctulate; third to sixth segments together as long as the second, indistinctly differentiated. Basal segment ferruginous, the rest piceous; third segment with an indistinct broad pale band near the middle, which is repeated less distinctly on the third, fourth and fifth. Ovipositor brownish-yellow, shorter than the first abdominal segment. Legs slender, testaceous, hairy.

Two females from Cold Spring Harbor, Long Island, New York.

This little subapterous species might perhaps be referred to Ashmead's genus *Pambolidea*, the type of which has not been described, so far as I can ascertain. However, the ovipositor is short and the second abdominal segment much smaller. The more or less distinctly differentiated abdominal segments separate it from the more typical species of *Pambolus*.

***Ecphylus texanus* sp. nov.**

Female. Length 3.5 mm. Piceous black; head rufous; antennæ brownish-yellow at the base, piceous apically. Palpi and legs, except four posterior femora, pale testaceous; tip of abdomen, ovipositor and its sheaths except at apex rufous or brown. Head polished behind, in front microscopically rugulose, with a median raised polished stripe below the antennæ. Cheeks as wide as the eyes. Antennæ slender, 21-jointed, extending to beyond the middle of the abdomen; first flagellar joint longest, as long as the width of the eye, following subequal but growing shorter, the last few only a little more than half as long as the first. Middle lobe of mesonotum transversely rugulose, impressed in front and depressed behind; lateral lobes shining, elevated posteriorly; scutellum triangular, with a transverse fovea crossed by numerous carinæ at its base. Metanotum finely rugulose, with a median carina and two less clearly defined lateral carinæ on each side. Abdomen one-half longer than the head and thorax together, sessile, spatulate; first segment longitudinally striated, twice as wide at the tip as at the base; following smooth and highly polished. Ovipositor one-fourth shorter than the body, but its sheaths are fully as long as the body. Wings hyaline, stigma and veins fuscous. Second transverse cubitus entirely wanting and the cubitus beyond the first cubital cell is very indistinct. Transverse median nervure in front wings wanting.

One female from Esperanza Ranch, Brownsville, Texas.

This is quite closely related to *E. hypothernemi*, Ashmead, but differs by its much greater size, pale color and longer ovipositor.

Public Museum, Milwaukee, Wis.

April 4, 1907.

ON THE FERTILIZATION OF THE EGGS OF ASTERIAS AND ARBACIA BY SPERM IMMersed
IN SOLUTIONS OF ALCOHOL, ETHER,
AMMONIUM HYDROXIDE, OR
AMMONIUM CHLORIDE.

BY ELLEN TORELLE.

Alcoholic solutions of sea-water, ranging from .5% to 8%, may induce activity in inactive spermatozoa of *Asterias forbesii*, but an 8% or a 10% solution is more frequently effective.

When inactive immature spermatozoa are immersed in ether, the greatest activity is induced by 1% or 2% solutions. A .5% solution of ether produces some activity, as does a 5% solution, but the activity so produced is of short duration. Weak solutions (.1% to 1%) of ammonium hydroxide, or of ammonium chloride, are also effective.

When active spermatozoa of *Asterias forbesii*, normally capable of fertilizing eggs, are placed in alcoholic solutions of sea-water, ranging from 1% to 8% in strength, their activity is increased. When they are placed in stronger solutions, their activity is decreased. In solutions above 10%, the spermatozoa usually become immediately quiescent. The activity of spermatozoa placed in weaker solutions, may continue for twelve hours or more;* those placed in 9% and 10% solutions usually become quiescent within two hours.

In solutions of ether, ranging from .5% to 2%, the activity is greatly increased, the spermatozoa in the .5% and 1% solutions may continue active for twenty-four hours.†

In ammonium hydroxide solutions of .001%, .005% and .01%, the spermatozoa become very active immediately upon immersion, but remain so only about five minutes in the first two, while in the last, they may continue active for two hours.

*This may be due to the fact that the solute is constantly evaporating, gradually producing a weaker solution.

†In solutions above 2% the activity is decreased.

In the ammonium chloride solutions of .1% and .5%, the activity of the spermatozoa is increased; but they continue active for some hours, only in the .01% solution.

Active and inactive sperm of *Arbacia* is affected by the solutions named above, in essentially the same way as is that of *Asterias*, with the difference that *Arbacia* sperm does not become active so readily.

During August and September, 1903, at the Marine Biological Laboratory, in Woods Hall, Mass., a series of experiments were carried out on the eggs of *Asterias forbesii* and *Arbacia punctulata*, with the object of discovering if spermatozoa normally ineffective in fertilization, could be rendered effective by immersion in the solutions named above, and also to see if changes brought about in active spermatozoa by an immersion in such solutions, would affect the development of the egg. In this paper no account will be given of the results as seen in sections of the eggs; these will be given in a later paper.

In the care of eggs and sperm, and in the manipulation of instruments and dishes, the usual precautions to prevent contamination, were taken. The eggs to be fertilized were placed in small glass crystals, or in finger-bowls, with an ample amount of sea-water. The spermatozoa, after immersion, were added to the eggs by means of a pipette, at intervals of one, five, ten and fifteen minutes, and, in some experiments, after an immersion of twenty and thirty minutes. The eggs so fertilized were compared with eggs normally fertilized and kept as a control. In each experiment, the condition of the spermatozoa before immersion was observed; the effect of immersion for shorter or longer periods of time in the various solutions used; the per cent of eggs which divided after fertilization by the spermatozoa which had been immersed; and, in most cases, the development of the eggs was watched for two days or more.

It was observed that spermatozoa, rendered inactive by being placed in certain of the stronger solutions, recovered their activity to some extent on being replaced in sea-water.* It is, therefore,

*See Table II. Exper. b.

probable that spermatozoa from all solutions recover to a greater or less degree on being added to the sea-water containing the eggs. That recovery is not complete, as Hertwig ** found it to be in the case for spermatozoa immersed in nicotin, is shown by the fact that eggs fertilized by spermatazoa, which had been immersed in weak solutions for a considerable time, or by spermatozoa immersed in strong solutions for a shorter time, the amount transferred invariably being the same, showed a large percentage of abnormalities in cleavage. The relation between the *time of immersion of the spermatozoa* and the *number of eggs which divide* after fertilization by such spermatozoa, is very striking, as shown by the following table, in which the results of the first series of experiments with *Arbacia* eggs and sperm are given. The eggs of one female, and the active sperm of one male, were used. The development of the eggs was observed for six days:

TABLE I.
Experiment a. SOLUTIONS OF ALCOHOL.
Arbacia Eggs and Sperm.

Per cent. Alcohol.	Time immersed.	Effect on sperm.	Per cent. divided.	Development after 24 hours.	Development after 48 hours.
10	1 min.	inactive	2	Dead.	
7	1 min.	active	20	Gastrulae.	Plutei.
†5	1 min.	active	95	Gastrulae.	Plutei.
†3	1 min.	active	98	Gastrulae.	Plutei.
†1	1 min.	active	99	Gastrulae.	Plutei.
10	10 min.	inactive	.5	Dead.	
7	10 min.	active	1	Dead.	
5	10 min.	active	90	Blastulae & beg. Gast.	Gastrulae.
3	10 min.	active	90	" & 3% "	Gastrulae.
1	10 min.	active	99	" & 10% "	Gastrulae.

**Hertwig, O. and R. "Ueber den Befruchtungs und Teilungsvorgang des tierischer Eies unter dem Einfluss äusserer Agentien," Jena, 1887.

†The embryos developed from spermatozoa immersed in these solutions for 1 min. were alive the sixth day. All others were dead the fourth day.

From the above experiment, it is seen that an immersion in a 10% alcoholic solution produces inactivity in the spermatozoa, and a consequent ineffectiveness in their fertilizing ability. Although they recover to some extent on being placed in seawater, the few eggs fertilized by such spermatozoa do not develop into gastrulæ. The experiment also shows that in solutions ranging from 1% to 5%, the activity is not lessened, nor is the fertilizing ability greatly impaired; and it is clearly seen that an immersion for ten minutes in 7%, 5% and 3% solutions not only causes a lesser number of eggs to divide, but retards the development of those which so divide.

Spermatozoa from the male used in Experiment a, were also immersed in solutions of ether, and the eggs fertilized by such spermatozoa were compared with those normally fertilized. The eggs normally fertilized practically all divided. Experiment b, Table II, shows the result of the immersion of the spermatozoa.

TABLE II.

Experiment b. ETHER SOLUTIONS.*Arbacia* Eggs and Sperm.

Per cent. Ether.	Time immersed.	Effect on sperm.	Per cent. divided.;	Further development.
.5	1 min.	active	99	All blastulæ in 16 hrs. Apparently more active than those normally fertilized.
1.	1 "	very active	99	All blastulæ.
2.	1 "	active	98	All stages of division as well as blastulæ.
5.	1 "	inactive	0	
.5	10 min.	active	99	Development further advanced than in .5% 1 min.
1.	10 "	very active	99	Beginning gastrulæ when 1%, 1 min. were blastulæ; very active; shoot across field.
2.	10 "	active	90	All stages of development seen, from 4 cell to gastrulæ.
*5.	10 "	inactive	25	All stages from 4 cell to gastrulæ.

From Experiment b, Table II, it is seen that a 1% ether solution produces the greatest activity in spermatozoa, while a 5% solution, produces quiescence. Eggs fertilized by spermatozoa immersed in .5% and 1% solutions for one or for ten minutes, develop apparently normally; but the embryos seem more active than those normally fertilized. Also, eggs fertilized by spermatozoa immersed for ten minutes develop more rapidly than do those fertilized by spermatozoa immersed for one minute, and are in the gastrula stage when the latter are in the blastula stage. I cannot account for the fact that the spermatozoa immersed for ten minutes in 5% ether and rendered inactive, recovered sufficiently to fertilize 25% of the eggs to which they were added, while the spermatozoa immersed for one minute, did not fertilize any eggs. Later in the season, spermatozoa immersed in 5% ether did in no case fertilize eggs.

In Experiment c, Table III, the effect of immersion in ammonium hydroxide is shown. Eggs and sperm from the male and female, used in Experiments (a) and (b), were also used in this experiment.

TABLE III.

Experiment c. AMMONIUM HYDROXIDE SOLUTIONS.

Arbacia Eggs and Sperm.

Per cent. NH ₄ OH	Effect on sperm.	Time immersed.	Per cent. divided.	Further Development.
.01	inactive	5 min.	3	Did not develop after first few cleavages.
.005	inactive	5 min.	5	Did not develop after first few cleavages.
.001	active	5 min.	95	Became abnormal morulae.
.01	inactive	10 min.	2	No development after <i>first</i> division.
.005	inactive	10 min.	2	No development after <i>first</i> division.
.001	active	10 min.	95	Became abnormal morulae.

Experiment c, Table III, shows that .01% and .005% solutions of ammonium hydroxide produced inactivity in the spermatozoa, and that only a few eggs (2%-5%) divided after fertilization by such spermatozoa. The eggs which were fertilized by such spermatozoa after immersion for ten minutes divided only once; those fertilized after an immersion of one minute divided several times, but did not reach the morula stage. Spermatozoa immersed in a .001% solution remained active and fertilized a large percentage of eggs which later developed into abnormal morulae.

In general, the experiments show that the immersion of the spermatozoa of *Arbacia* in alcoholic solutions of certain strengths, seems to retard the development of eggs subsequently fertilized by them. Immersions in ether solutions, on the other hand, seems to accelerate the rate of development. After immersion in ammonium hydroxide (.01% and .005%), practically no development follows, although division and abnormal development takes place after immersion of the spermatozoa in very weak (.001%) solutions. When ammonium chloride was tried in .1% and .5% solutions, a few eggs segmented even when fertilized by spermatozoa immersed for twenty minutes. When eggs were fertilized by sperm immersed in .5% ether for thirty minutes, they developed into plutei like the normal ones, with the difference that the rays (arms?) were shorter, and the alimentary canal projected outward ventrally.

After immersion of the sperm in 5% alcohol for thirty minutes, division of practically all eggs followed, but the cells were atypical, and the morulae assumed a crenate, shrunken appearance. In many cases, eggs fertilized by spermatozoa immersed for ten and fifteen minutes in 8%, 7%, and 5% alcohol, showed a tendency to divide in one plane only (the horizontal) after the four-cell stage.

Very active sperm, when immersed in alcohol for some time, was rendered incapable of fertilizing. In one experiment, designed to test the effect of prolonged immersion, the eggs, quite mature, and in excellent condition—practically all developing after normal

fertilization—were fertilized by spermatazoa immersed for twenty minutes in 5%, 8%, 9%, 10%, 11%, and 12% alcohol solutions, respectively; in .5%, 1%, 2%, and 5% ether solutions; and in .1% and .5% ammonium chloride solutions. Of these, 25% of the eggs fertilized by spermatazoa, immersed in 5% alcohol developed, 1% of the eggs fertilized by spermatazoa immersed in the 2% ether solutions; practically all from the spermatazoa immersed in .5% and 1% ether; and *none* from any of the other and stronger solutions. Early in the season, eggs sometimes, although rarely, divide (as indicated in Table II) after fertilization by spermatazoa immersed in 5% ether. Later, several experiments showed no division after immersion in 5% ether for ten minutes.

In *Asterias*, the relation between a prolonged immersion of spermatazoa in weak solutions, and an immersion in stronger solutions for a shorter period of time, becomes quite evident. Table IV, p. 119, shows the results of a series of experiments carried out to test this relation.

This table shows that immersion for twenty minutes in alcoholic solutions, ranging from 5% to 12%, is fatal to the spermatazoa of *Asterias*, at least as regards their ability to fertilize the eggs to which they are added. An immersion for ten minutes in solutions above 10% is also fatal. When immersed for one minute, eggs are fertilized from all solutions, except 12%. Immersion in 5% ether is fatal for all the periods of time indicated, and immersion in a .1% solution of ammonium chloride for a longer period than one minute, prevents fertilization of the eggs by the sperm, as does a .5% solution after all the intervals of time designated.

In all the experiments carried out, abnormal division of many eggs was observed after immersion of the sperm in strong solutions, or in weak solutions for a longer period of time, although a larger number of eggs might divide as a result of fertilization by such sperm. In one series of experiments, eggs were selected, which, normally fertilized, showed a division of practically all of the eggs. Very active spermatazoa were immersed in solutions

TABLE IV.

Asterias' Eggs and Sperm.

Per cent. Alcohol.	Time immersed.	Per cent. divided.	Per cent. Ether.	Time immersed.	Per cent. divided.	Per cent. NH ₄ Cl.	Time immersed.	Per cent. divided.
5	1 min.	50	.5	1 min.	75	.1	1 min.	25
8	1 "	50	.7	1 "	50	.1	10 "	0
9	1 "	40	2	1 "	50	.1	20 "	0
10	1 "	25	5	1 "	0	.1	30 "	0
11	1 "	20						
12	1 "	0						
5	10 "	25	.5	10 "	75	.5	1 "	0
8	10 "	1	.7	10 "	50	.5	10 "	0
9	10 "	1	2	10 "	25	.5	20 "	0
10	10 "	0	5	10 "	0	.5	30 "	0
11	10 "	0						
12	10 "	0						
5	20 "	0	.5	20 "	70			
8	20 "	0	.7	20 "	33			
9	20 "	0	2	20 "	1			
10	20 "	0	5	20 "	0			
11	20 "	0						
12	20 "	0						
			.5	30 "	50			
			.7	30 "	20			
			2	30 "	0			
			5	30 "	0			

for ten and twenty minutes. Among the eggs fertilized after an immersion of ten minutes, abnormal division occurred from the 1%, 2%, and 5% ether solutions. Of those fertilized from the 8% and 9% alcoholic solutions, 75% were abnormal, although more than 75% divided. Very few divisions occurred from the 10% and 11% solutions, but abnormalities were conspicuous among those that did divide. From the 12% solutions, only about 5% of the eggs divided, and all abnormally. In most cases, the protoplasm became merely constricted. The eggs fertilized by spermatozoa immersed for twenty minutes were more abnormal than those fertilized after ten minutes, and a smaller per cent divided. Eggs developed to the morula stage from 1% and 2%

solutions and from 8% and 9% solutions of alcohol. There were none from the other solutions.

No division occurred after the immersion of spermatozoa in weak (.001%) solutions of ammonium hydroxide.

When inactive sperm of *Asterias* or of *Arbacia* is immersed in solutions of alcohol, ether or ammonium chloride in sea-water, it not only becomes active, but in some cases is rendered capable of fertilizing eggs not normally fertilized by the same sperm. Fertilization did not always take place, even when the spermatozoa became active and surrounded the eggs on being added to them.

In order to discover whether the eggs or the sperm were responsible for this lack of fertilization, a series of experiments was carried out, in which the eggs of two females and the sperm of two males, was used. The eggs were ripe and in good condition. The spermatozoa were altogether inactive and did not normally fertilize the eggs. Eggs and sperm were used interchangeably, as shown in Table V, p. 121.

After immersion in solutions of alcohol, ether, and ammonium chloride, as indicated in Table V, the inactive spermatozoa of both males became active. The spermatozoa of Male I fertilized the eggs of both Female I and Female II, except after immersion in 10% alcohol solutions, and, in one case, an immersion in 2% ether. [See (d).]

The spermatozoa of Male I did not in any case fertilize the eggs of Female I, but in all cases, except after immersion in 10% alcohol, they fertilized the eggs of Female II.

After fertilization by the spermatozoa of Male I, immersed in 1% solutions of alcohol and of ether for five minutes, 50% to 95% of the eggs of Female I and of Female II divided, and 1% divided after an immersion of the spermatozoa in 0.1% NH_4Cl .

A small number only divided after fertilization by spermatozoa immersed in the stronger solutions for the same length of time; and, with one exception [See 6], none divided after immersion in the strongest solution used.

After fertilization by the spermatozoa of Male II, immersed in 1% alcohol for five minutes, 80% of the eggs of Female II divided,

TABLE V.
Asterias' Eggs and Sperm.
(Used Interchangeably.)

(a)				(b)			
Female I Male I	Per cent. Alcohol.	Time sperm immersed.	Per cent. eggs divided	Female II Male I	Per cent. Ether.	Time sperm immersed.	Per cent. eggs divided
"	1	5 min.	90	"	1	5 min.	95
"	2	5 "	5	"	2	5 "	5
"	5	5 "	5				
"	10	5 "	0				
(c)				(d)			
Female II Male I	Per cent. Alcohol.	Time sperm immersed.	Per cent. eggs divided	Female II Male I	Per cent. Ether.	Time sperm immersed.	Per cent. eggs divided
"	1	5 min.	50	"	1	5 min.	90
"	2	5 "	1	"	2	5 "	0
"	5	5 "	1				
"	10	5 "	0				
(e)				(f)			
Female I Male II	Per cent. Alcohol.	Time sperm immersed.	Per cent. eggs divided	Female I Male II	Per cent. Ether.	Time sperm immersed.	Per cent. eggs divided
"	1	5 min.	0	"	1	5 min.	0
"	2	5 "	0	"	2	5 "	0
"	5	5 "	0				
"	10	5 "	0				
(g)				(h)			
Female II Male II	Per cent. Alcohol.	Time sperm immersed.	Per cent. eggs divided	Female II Male II	Per cent. Ether.	Time sperm immersed.	Per cent. eggs divided
"	1	5 min.	80	"	1	5 min.	90
"	2	5 "	2	"	2	5 "	5
"	5	5 "	2				
"	10	5 "	0				
(i)				(j)			
Female I Male I	Per cent. NH ₄ Cl	Time sperm immersed.	Per cent. eggs divided	Female II Male I	Per cent. NH ₄ Cl	Time sperm immersed.	Per cent. eggs divided
"	0.1	5 min.	1	"	0.1	5 min.	1
(k)				(l)			
Female I Male II	Per cent. NH ₄ Cl	Time sperm immersed.	Per cent. eggs divided	Female II Male II	Per cent. NH ₄ Cl	Time sperm immersed.	Per cent. eggs divided
"	0.1	5 min.	0	"	0.1	5 min.	2

and 90% of the eggs of the same female divided after an immersion of the sperm in 1% ether. No eggs of Female II divided after immersion of the sperm in 10% alcohol, but 5% of the eggs divided after the immersion of the sperm in 2% ether; 2% of the eggs of Female II divided after the immersion of the sperm in 0.1% NH_4Cl —a larger number than any which divided after immersion of the sperm— NH_4Cl .

Table V also shows that a smaller percentage of the eggs of Female II divided after fertilization by spermatozoa from Male I, than was the case with the eggs of Female I, although the spermatozoa were immersed in solutions of the same strength and for the same periods of time.

From these results, it appears that inactive sperm can be made functionally active by immersion in the above named solutions, and that the absence of fertilization in the same cases cannot be said to be due to the sperm alone, or, on the other hand, to the eggs alone, but to a mutual incompatibility of the two elements, even after the spermatozoa have become active.

SUMMARY:

Inactive spermatozoa of *Asterias* or of *Arbacia* are rendered active by immersion in solutions of alcohol, ether, and ammonium chloride, in sea-water. In some instances, spermatozoa, thus made active, fertilize eggs not fertilized by them before immersion in the solutions.

In *Arbacia*, strong solutions of alcohol (10% and above), produce inactivity in active spermatozoa. A few of the eggs to which such inactive spermatozoa are added, divide, but they do not reach the later development stages.

Weak solutions of alcohol (from 1% to 5%) produce greater activity in the spermatozoa, and a large per cent of the eggs to which they are added, divide. But if the spermatozoa are immersed for ten minutes or longer in these solutions, the development of the eggs fertilized by them is retarded.

A 5% ether solution produces inactivity in active spermatozoa; their activity is increased in .5% and 1% solutions.

Eggs fertilized by spermatozoa immersed in .5% and 1% ether solutions develop more rapidly, and the embryos are more active than those produced by normal fertilization. The rate of development is increased by an immersion before fertilization of the spermatozoa for several minutes, instead of one minute in the .5% and 1% ether solutions.

In most of the experiments, when the spermatozoa were immersed in 5% ether for one or for ten minutes, and then added to eggs in sea-water, division of the eggs did not take place.

An immersion of spermatozoa in the ammonium hydroxide solutions used, stronger than .001% produces inactivity in the spermatozoa; only a few eggs divide after such spermatozoa have been added to them, and the eggs which divide do not survive the first few cleavages. A large percentage of eggs divide after fertilization of spermatozoa, which have been immersed in .001% of ammonium hydroxide, but do not reach the gastrula stage.

In *Asterias*, no eggs divide when spermatozoa are added to them after an immersion of twenty minutes in solutions of alcohol, ranging from 5% to 12%.

Eggs of *Asterias* divide when spermatozoa are added to them after an immersion of ten minutes in 5% to 8% solutions of alcohol; when spermatozoa are immersed for one minute only in solutions ranging from 5% to 11%, division occurs in the eggs to which they are added.

Abnormal division and development follows the fertilization of eggs by sperm immersed in 10% to 12% alcohol solutions, and by sperm immersed in 2% to 4% ether solutions.

CONCLUSIONS.

The entire series of experiments show:

1. That inactive (immature?) spermatozoa can be made

functionally active by immersion in certain solutions of alcohol, ether or ammonium chloride.

2. That the number of eggs which divide after fertilization by active spermatozoa immersed in the various solutions, is dependent upon the *time* of immersion.

3. That abnormal development is produced by a prolonged immersion of the spermatozoa in the solutions used.

4. That prolonged immersion in weak solutions tends to have the same effect as a shorter immersion in strong solutions.

A NEW APIOCERA FROM SOUTH AFRICA.*

By A. L. MELANDER,

Professor of Entomology, The State College of Washington.

The family Apioceridæ is small. About a dozen species are known the world over, and of these about one-half are from North America. According to a recent catalogue of African diptera,** by Professor Mario Bezzi, no African species of this group has been described. Apioceridæ live in the arid plains of the Western States, but, with the exception of *Apiocera haruspex* Osten Sacken, they are quite rare.

In a most interesting collection of Diptera received from Dr. Hans Brauns of Willowmor, Cape Colony, I find a beautiful species of this archaic group. It gives me much pleasure to dedicate the species to this observant entomologist. The collections sent by Dr. Brauns seem remarkable to the American collector, although the forms, he states, are the commoner ones of his locality. A preponderance of the specimens belong to the Asilidæ. Several different Mydaidæ, numerous Tabanidæ, especially Pangonias, curious Bombyliidæ, Cyrtidæ, and Conopids, all bespeak the dry and arid character of the high steppes of the Cape. In one letter written in late April, Dr. Brauns stated that it had not rained since the September previous. Accordingly, there is a dearth of the moisture-loving diptera, such as Leptidæ, Dolichopodidæ, Empididæ, Tipulidæ, etc. To many of us it may seem strange to recall that the collecting season of the entomologist of the antipodes is confined to our winter months.

*Contributions from the Zoological laboratory of the State College of Washington, Pullman, Washington.

**Ditteri Eritrei. Bull. del. Soc. entomol. ital., XXXVII, 1905.

***Apiocera braunsi* sp. nov. Plate 1.**

Male. Length of body 18 mm., length of wing 9.5 mm. A black species ornate with white pollen and pubescence. Head very small. Front broad, white pollinose, but with a broad mesial vitta piceous. This vitta is suddenly narrowed just above the antennæ. The very sparse pile of the front corresponds in color to its basement, except that there is an irregular row of blackish hairs along the margin of the eye at the vertex. Anterior ocellus crescentic, light-colored, the posterior pair small, situated on the borders of the median vitta. Face short, fuscous, bare; genæ with a narrow white-pollinose stripe separating the eyes from an elongate velvet-black macula. Upper part of the flattened occiput blackened except at the margin of the eyes, where it is white pollinose like the lower portion; upper portion of the occiput with numerous black bristly hairs; the dense beard white.

The securiform palpi testaceous, white pollinose, and provided with sparse black hairs above. Proboscis short, piceous, loosely provided with dusky pubescence below, and with a bunch of white hairs behind. Antennæ short, black, the second joint smaller than the first, the upper and outer sides of the globose third joint dull fuscous; the first two joints provided with black bristles above, the first joint with long white hairs below.

Thorax short, mesonotum blackish, provided with brownish pollen, except on four equidistant broad white-pollinose vittæ, the middle pair of white vittæ are abbreviated on the last fourth of the dorsum, the outer pair begin on the humeri and extend back to include the white pollinose scutellum, pleuræ entirely white pollinose. Pronotum white pubescent and with a collar of short black bristles, mesonotum loosely provided with dusky hairs, pleuræ bare, prosternum with bushy white pubescence. All the bristles of the thorax comparatively short, black; humeri with four or five bristles; the outermost black vittæ with black hairs and about six bristles; about four supra-alar bristles present; post-alar callus with three longer bristles; a single pair of prescutellar bristles present; scutellum with six marginals.

Abdomen long, black, subshining, especially posteriorly, white fasciate on the hind border of the first six segments, the white border excised in the middle in front on the first and second segments, and on the third and fourth segments it becomes attenuated at the sides, the fifth, sixth, and seventh segments white pollinose at the base, on the sixth segment the black ground color is obliterated except on the



APIOCERA BRAUNSI MELANDER.

sides, venter loosely white pollinose. Hairs of the abdomen black, short, and sparse, the first four ventrals with longer white pubescence.

Hypopygium large, terminal, valvate, black, shining, and more densely black hairy than the rest of the body; the upper valves slightly shorter than the lower, the hairs becoming longer at their apex, the middle of the upper side bowed out so as to accommodate a pair of short black filaments; lower valves tipped with a dense fascicle of pure white, flattened hairs.

Ground color of legs black, becoming reddish apically. Coxæ closely white pollinose; front coxæ white pubescent and with a few white bristles beneath; middle and hind coxæ with straggling white hairs, and each with a lateral vertical row of three black bristles as well as with an apical fringe beneath. Femora more loosely pollinose, all the femora with a row of about six black bristles along the outer lower edge, front femora with a similar row of longer bristles along the upper edge. Tibiæ and tarsi subshining, more closely black bristly, the bristles of the hind tarsi long, pulvilli small.

Wings small, clear hyaline, veins narrow, blackish; neuration normal, second submarginal cell four times as long as broad, fourth posterior cell narrowly sessile with the second basal. Halteres destroyed.

Described from a single male taken by Dr. Hans Brauns, January 1, 1905, at Willowmore, Cape Colony, South Africa.

ADDITIONS TO THE LEPIDOPTEROUS FAUNA OF MILWAUKEE COUNTY.

BY RICHARD A. MUTTKOWSKI.

The following list, comprising 187 species of Lepidoptera from Milwaukee County, Wisconsin, is intended as a supplement to a former list published in the Bulletin of this Society,* where 901 species are enumerated. This, therefore, brings the recorded number of species up to 1,088. Probably a very few of these will have to be eliminated in the future, but in its present form the list represents very well the local fauna. Most of the additional names here recorded are based on material contained in the collections of the Milwaukee Public Museum, but a few species not represented in the Museum collection are cited on the authority of Mr. Valentine Fernekes.

PAPILIONIDÆ.

IPHIDICLES Hbn.

5a *telamonides* Feld.

5b *marcellus* Bdv. & LeC.

PAPILIO Linn.

14 *thoas* Linn.

LAERTIAS Hbn.

23 *philenor* Linn.

PIERIDÆ.

CALLIDRYAS Bdv. & LeC.

52 *eubule* Linn

EURYMUS Swain.

66a *anthyle* Hbn.

NYMPHALIDÆ

AGRAULIS Bdv. & LeC.

91 *vanillæ* Linn.

LEMONIAS Hbn.

166 *hoffmanni* Behr.

CHARIDRYAS Scudd.

— *pascoensis* Wright.

PHYCIODES Hbn.

187 *vesta* Edw.

188 *phaon* Edw.

POLYGONIA Hbn.

209 *faunus* Edw.

*Vol. 4, Nos. 1-2, April 1906, pp. 39-58.

LYCÆNIDÆ.

URANOTES Scudd.

335 *melinus* Hbn.

THECLA Fabr.

345 *edwardsii* Saund.

STRYMON Hbn.

384 *titus* Fabr.

HESPERIIDÆ.

AMBLYSCHIRTES Scudd.

459 *vialis* Edw.464 *ænus* Edw.

HYLEPHILA Billb.

512 *campestris* Bdv.515 *phylæus* Dru.

THYMELICUS Hbn.

516 *brettus* Bdv. & LeC.

LIMOCHROES Scudd.

556 *pontiac* Edw.560 *arpa* Bdv. & LeC.

PHYCANASSA Scudd.

564 *viator* Edw.566 *vitellius* Fabr.

EUDAMUS Swain.

577 *proteus* Linn.

PHOLISORA Scudd.

605 *catullus* Fabr.

THANAOS Bdv.

617 *brizo* Bdv. & LeC.

SPHINGIDÆ.

AMPELOPHAGA Brem. & Grey.

682a *cnotus* Hbn.

SATURNIIDÆ.

CALLOSAMIA Pack.

745 *angulifera* Walk.

HEMILEUCA Walk.

757a *lucina* Edw.

LITHOSIIDÆ.

CRAMBIDIA Pack.

802 *cephalica* Gr. & Rob.

HYPOPREPIA Hbn.

809 *cadaverosa* Streck.

ARCTIIDÆ.

EUBAPHE Hbn.

834b *ferruginosa* Walk.834c *brevicornis* Walk.

HAPLOA Hbn.

842a *lumbonigera* Dyar.

HYPHANTRIA Harr.

856 *textor* Harr.

DIACRISIA Hbn.

862a *fumosa* Streck.

APANTESIS Walk.

878a *approxinata* Stretch.885 *proxima* G-M.893 *placentia* S. & A.

NOCTUIDÆ.

APATELA Hbn.

982 *leporina* Linn.994 *furcifera* Gn.995 *hasta* Gn.1001 *spinigera* Gn.1007 *connecta* Grote.1027 *hæsitata* Grote.1039 *impleta* Walk.

MEROLONCHE Grote.1050 *lupini* Grote.**CATABENA Walk.**1084 *lineolata* Walk.**PLATYSENTA Grote.**1088 *videns* Gn.1089.1 *angustiorata* Grote.**CARADRINA Ochs.**1103 *exigua* Hbn.**OLIGIA Hbn.**1136 *festivoides* Gn.**HADENA Schrank.**1202. *miscloides* Gn.1214 *burgessi* Morr.1228 *plutonia* Grote.**SEMIOPHORA Steph.**1426 *elimata* Gn.1428 *tenebrifera* Walk.**PERIDROMA Hbn.**1468 *incivis* Gn.**NOCTUA Linn.**1491 *collaris* G. & R.1514 *lubricans* Gn.**CHORIZAGROTIS Smith.**1518 *introferens* Grote.1519 *agrestis* Grote.**FELTIA Walk.**1551 *malefida* Gn.**PARAGROTIS Pratt.**1574 *quadridentata* G. & R.1578 *oblongostigma* Smith.1598 *perpolita* Morr.1603 *velleripennis* Grote.1662 *comosa* Morr.1699 *titubatis* Smith.**MAMESTRA Ochs.**1837a *illaudabilis* Grote.1843 *erecta* Walk.**GRAPHIPHORA Hbn.**2035 *saturnus* Streck. (?)**XYLINA Ochs.**2079 *petulca* Grote.2106 *unimoda* Lint.2113 *capax* G. & R.**CALOCAMPA Steph.**2121 *curvimacula* Morr.**CUCULLIA Schrank.**2128 *floreæ* Gn.2132 *intermedia* Spey.**NONAGRIA Ochs.**2151 *subflava* Grote.**GORTYNA Ochs.**2167 *obliqua* Harv.**PAPAPEMA Smith.**2181 *necopina* Grote.2183 *cerussata* G. & R.**SCOPELOSOMA Curt.**2237 *moffattina* Grote.**TRILEUCA Grote.**— *delicia* Dyar.**HELIOTHIS Ochs.**— *ochracea* Ckll.**SCHINIA Hbn.**2366 *brevis* Grote.**MELANOPORPHYRIA Grote.**2397 *oregona* Edw.**AXENUS Grote.**2419 *arvalis* Edw.**EUTHISANOTIA Hbn.**2428 *unio* Hbn.

AUTOGRAPHA Hbn.2515 *epigæa* Grote.2519 *falcifera* Kby.**MARASMALUS Grote.**2551 *inficita* Walk.**PHIPROSOPUS Grote.**2573 *callitrichoides* Grote.**ISOGONA Gn.**2739 *natatrix* Gn.**DRASTERIA Hbn.**2755a *ochrea* Grote.2755b *distincta* Neum.**SYNEDA Gn.**2795 *howlandii* Grote.**CATOCALA Schrank.**2806 *epione* Dru.2811 *viduata* Gn.2814 *dejecta* Streck.2815 *relecta* Grote.2827a *sylvia* Edw.2828a *nurus* Walk.2841 *junctura* Walk.2857b *petulans* Hulst.2865b *uzor* Gn.2865c *osculata* Hulst.2868 *piatrix* Grote.2873a *annida* Fag.2888 *clintonii* Grote.2892a *cratægi* Saund.2898 *fratercula* G. & R.2898b *jaquenetta* Edw.2898f *gisela* Meyer.**HYPOCALA Gn.**2912 *andremona* Cram.**PANOPODA Gn.**2920 *rustmargo* Hbn.2920a *carneicosta* Gn.**CELIPTERA Gn.**2946 *frustulum* Gn.**ZANCLOGNATHA Led.**3023 *protumnusalis* Walk.**TETANOLITA Grote.**3052 *mynesalis* Walk.**CAPIS Grote.**3060 *curvata* Grote.**BOMOLOCHA Hbn.**3064 *manalis* Walk.**NOTODONTIDÆ.****MELALOPHA Hbn.**3092 *apicalis* Walk.3093 *inornata* Neum.**PHEOSIA Hbn.**3119 *portlandia* Edw.**HETEROCAMPA Doub.**3142 *bilineata* Pack.**SCHIZURA Doub.**3152 *apicalis* B. & R.**GLUPHISIA Bdv.**3168 *severa* Edw.3169 *lintneri* Grote.**LASIOCAMPIDÆ.****HETEROPACHA Harv.**3222 *rileyana* Harv.**EPICNAPTERA Ramb.**3223b *roseata* Stretch.**PLATYPTERYGIDÆ.****DREPANA Schrank.**3229a *genicula* Grote.

GEOMETRIDÆ.

TEPHROCLYSTIS Hbn.

- 3277 *miserulata* Grote.
3284 *rotundopuncta* Pack.

EUCHÆCA Hbn.

- *salienta* Pears.

EUSTROMA Hbn.

- 3351a *lugubrata* Moesch.

MESOLEUCA Hbn.

- 3372 *gratulata* Walk.

PETROPHORA Hbn.

- 3458 *spadicearia* D. & S.

SYNELYS Hulst.

- 3486 *alabastaria* Hbn.

CHLOROCLAMYS Hulst

- 2562 *phyllinaria* Zell.

SYNCHLORA Gn.

- 3580 *denticulata* Walk.

EUFIDONIA Pack.

- 3604 *notataria* Walk.
3604a *fidoniata* Walk.

DEILINEA Hbn.

- 3624 *erythremaria* Gn.

SCIAGRAPHIA Hulst.

- 3647 *granitata* Gn.
3650 *punctolineata* Pack.

MACARIA Curt.

- 3673 *eremiata* Gn.
3675 *aquiferaria* Walk.

CYMATOPHORA Hbn.

- 2709 *pustularia* Hbn.

ANAGOGA Hbn.

- 3898 *pulveraria* Linn.

THERINA Hbn.

- 3909 *athasiaria* Walk.
3910 *flscellaria* Gn.
3911 *fervidaria* Hbn.

XANTHOTYPE Warr.

- 3925a *cælaria* Hulst.

PLAGODIS Hbn.

- 3927a *rosaria* Grote.
3928a *nigrescaria* Hulst.
3929 *fervidaria* H-S.
3932 *emargataria* Gn.

EUCHLÆNA Hbn.

- 3962 *vinulentaria* G. & R.

SABULODES Gn.

- 4026a *goniata* Gn.

ELIPLEMIDÆ.

CALLIZZIA Pack.

- 4043 *amorata* Pack.

THYRIDIDÆ.

THYRIS Lasp.

- 4132 *lugubris* Bdv.

DYSODIA Clem.

- 4134 *oculatana* Clem.

SESIIDÆ.

SESIA Fabr.

- 4224 *pyri* Harr.

PYRALIDÆ.

DIASTICTIS Hbn.

- 4287 *argyralis* Hbn.

PYRAUSTA Schrank.

- *ochosalis* Fitch.

CRAMBUS Fabr.

4609 *luteolellus* Clem.

BENTA Walk.

4649a *diluculella* Clem.

ELASMOPALPUS Blanch.

4779 *floridellus* Hulst.

PTEROPHORIDÆ.

PLATYPTILIA Hbn.

4939 *acanthodactyla* Hbn.

4951 *petrodactyla* Walk.

TORTRICIDÆ.

OLETHREUTES Clem.

5042 *murina* Pack. l. sp.

5055 *chalybeana* Wals.

ANCYLIS Hbn.

5261 *goodelliana* Fern.

ALCERIS Hbn.

5312a *vidurnana* Clem.

ARCHIPS Hbn.

5361 *rileyana* Grote.

5379 *persicana* Fitch.

PLATYNOTA Clem.

5382 *flavedana* Clem.

TORTRIX Linn.

5395 *citrana* Fern.

PHALONIA Hbn.

5433 *straminoides* Grote.

ÆCOPHORIDÆ.

ETHMIA Hbn.

5898 *arctostaphylella* Wals.

HEPIALIDÆ.

STHENOPIS Pack.

6604 *argenteomaculatus* Harr.

6605 *quadriguttatus* Grote.

6606 *thule* Streck.

HEPIALUS Fabr.

6609 *mustelina* Pack.

6610 *gracilis* Grote.

BRIEFER ARTICLES.

SOME RECENT RESEARCHES IN THE QUATERNARY BEDS OF MARIGNAC IN THE COMMUNE OF TAURIDE, GIRONDE, FRANCE.

A paper read before the Linnean Society of Bordeaux, by François Daleau, presents some interesting recent discoveries made by that indefatigable explorer.

The quaternary alluvial deposits in many localities of the cantons of Bourg and Saint Savin have long been exploited at different altitudes for building sand and road gravel. His excavations in the sands of Sexcommunes had, until recently, not brought to light any finds except fossil wood, i. e., the silicified trunk of a tree that undoubtedly had been washed out of a lower formation by quaternary waters. In 1870, however, an incomplete maxillary and two teeth of an undetermined elephant taken from the sand of the left bank of the Dordogne River were given him, but without information as to the particular quarry whence they were taken. In 1889 he found *in situ* in a pit in Marignac, some flint implements shaped by man. The depth of the excavation reached 7 1-15 metres (30 feet) below the surface, penetrating the recent, middle and lower quaternary strata for 18 feet, and the upper and lower Tongrien beds of the Tertiary 12 feet or more.

The following relics were found in the *neolithic* strata, as defined by G. de Mortillet's schedule: A black flint nucleus; a quartzite hammer showing traces of battering; an oval, stationary mill, much used on both sides, all of the Solutréenne and Madalunéenne forms. In the *middle Quaternary*, ten bulbose and conchoidal flint flakes, due to a peculiar percussion characteristic of the Monstérienne period; a Monstérienne kind of pointed flint scraper chipped only on one side, covered by a white patine; and a very pretty small Acheuléen (perfected Chelléen form) flint implement, finely chipped on both sides, with a white patine on

one side and a yellow patine on the other; and an Acheuléen flaked flint, finely chipped on both surfaces.

In the *lower Quaternary* were found a superb Chelléen brown flint fist-ax, of almond shape, with large flakings on both sides, and over six inches long, taken from a wide cistern formed by currents in the Tertiary formation underlying the Quaternary; two other flint implements from the same bed; and four more that were not taken out of the undisturbed matrîx. No prehistoric bones were found. A local peasants' adage explains it thus: "Le sable maigre mange les os; la terre gros les conserve." "The meagre (siliceous) sand eats the bones; the fat earth (argilocalcareous) preserves them."

The discovery of such tools *in situ* 12 feet under the lowest quaternary stratum would mean great glory for Daleau, but he candidly states that the quaternary waters probably drilled out the pothole and deposited in it the implements. Nevertheless, the discovery was the first in Southern France, where Monstérien and Acheuléen (middle Quaternary) flint tools of human make were superimposed in their proper order over the Chelléen type of the inferior Quaternary, and where the latter were in contact with the Tertiary, thus corroborating the chronology of the Mortillet (father and son) who established the following schedule, now generally approved, although the localities Acheul and Chelles are nearly one hundred miles apart.

TABLE SHOWING THE SUCCESSION OF THE FRENCH
QUATERNARY FORMATIONS.

Upper Quaternary	Neolithic	Lacustrine Madalunéenne Solutréenne
Middle Quaternary	Palæolithic	Monstérienne Acheuléenne
Lower Quaternary		Chelléenne

I wish to call attention to a circumstance which Daleau does not mention. The finely chipped "perfected Chelléen" implement, with white patine on one side and yellow patine on the other face, would indicate that its owner pursued his game on the surface of the yellow tertiary bed of sand and that the implement assumed the yellow tint on its under side from the yellow sand which had become fine enough to hold it in place during the time that the earliest quaternary deposit was forming. This seems to justify the idea that the implement in question was made and deposited *during* the Tertiary, *before* the Quarternary sands were deposited.

CHARLES H. DOERFLINGER.

KING EIDERS AT MILWAUKEE,—A CORRECTION.

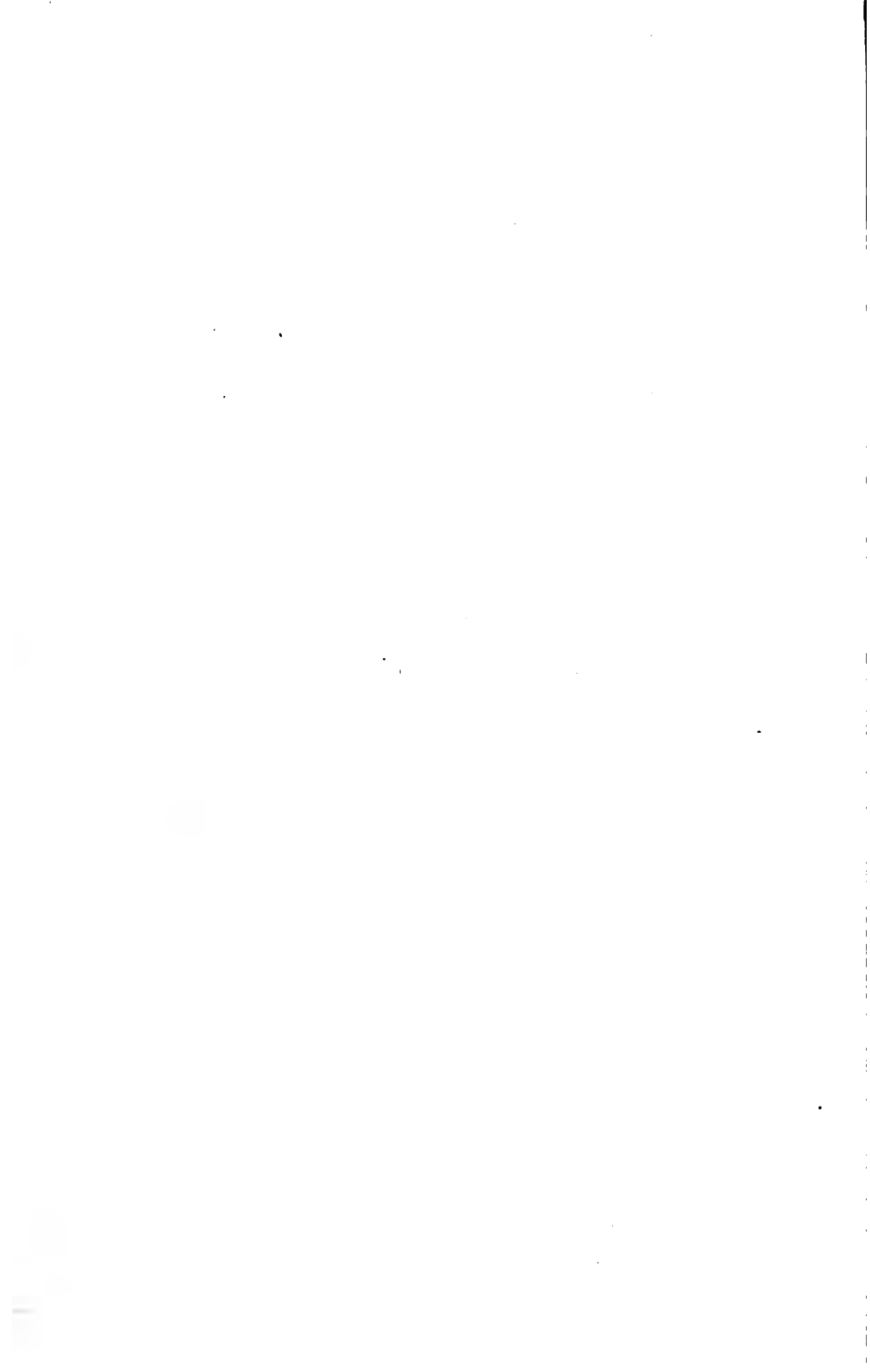
My attention has recently twice been called to a misleading statement on p. 113. Vol. IV of this Bulletin in my Notes Of (should read On) the Herring Gull and Caspian Tern, where, writing of the ducks coming into the river between the factory lined docks in winter, I mention them as being "principally Old Squaws, Lesser Scaup and King Eiders." This is an error, and as the sentence stands American Golden Eyes should be substituted for King Eiders. I have an imperfect recollection of having left the third place open for reference to some misplaced notes on the comparative numbers of the ducks and intending to record the king eider as occasional.

I know of only three specimens of king eider actually and certainly taken at this point. Two of these are recorded by Hollister in The Birds of Wisconsin, Wis. Nat. Hist. Society, Bull. Nos. 1, 2 and 3 of Vol. III, i. e., a female taken Dec. 25, 1899, and a male Jan. 1, 1900, both in the Copeland-Russel collection in this city; and a female taken within the harbor Nov. 28, 1903, and now in the Public Museum. The museum also possesses two other specimens, an adult and an immature male received by gift from the Wis. Nat. Hist. Socy. about twenty-five years ago, at the time of the founding of the museum. The only

data accompanying these are those of sex and "Lake Michigan, Wis." One of these is evidently referred to by Mr. Hollister when he writes, *l. c.*, "and there is now a specimen in the Milwaukee Public Museum, taken at Milwaukee many years ago."

Various times I have heard of water men about the harbor describing ducks seen in or near the harbor that were probably this species. Mr. Hollister writes, *l. c.*, "During our sojourn on the Great Lakes we are positive of having seen king eiders in small flocks several times in late fall. Being very familiar with the bird in the Arctic regions, we think there was no mistake." We incline to the belief that this species is not as uncommon in this region as its scarcity in local collections would indicate; but it is far from being the third commonest winter species.

HENRY L. WARD.







BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 5, New Series.

JULY, 1907.

No. 3.

PROCEEDINGS.

Milwaukee, April 11, 1907.

Meeting of the combined sections.

President Teller in the chair, and Messrs. Brues, Carpenter, Case, Copeland, Doerflinger, Ogden, Russell and Ward present.

Mr. Howland Russell gave some "Notes on Wisconsin Oaks." He read a recent paper by Prof. E. J. Hill from the Botanical Gazette, referring to the common occurrence of *Quercus ellipsoidalis* Hill in the vicinity of Milwaukee, and the probable absence of *Quercus palustris* Moench. in this region. Mr. Russell exhibited specimens of leaves and acorns of these and several other species, pointing out the various differential characters that separate them. Later the discussion was taken up by several members, after which the meeting adjourned.

Milwaukee, April 25, 1907.

Regular monthly and annual meeting of the Society.

President Teller in the chair and about ninety persons present.

The minutes of the last monthly meeting were read and approved.

Mr. Teller asked for nominations for the election of officers.

Mr. Doerflinger moved that the secretary be instructed to cast a unanimous vote for the re-election of the present incumbents.

The motion was seconded and passed and the officers elected as follows:

President—E. E. Teller.

Vice-President—H. L. Ward.

General Secretary—C. T. Brues.

Member of Board of Directors—S. Graenicher.

Publishing Committee—H. L. Ward, Geo. W. Peckham, C. E. Monroe.

The names of Mr. A. J. Wright and Rev. Frederick Edwards were proposed for membership and subsequently approved by the Board of Directors.

There being no further business, Mr. H. L. Ward addressed the meeting on "Museum Collecting." He described his experiences in collecting animals for museums in various parts of this country, Mexico, and the West Indies. The rediscovery of the West-Indian Seal was mentioned, and the manner in which he had obtained them. The collecting of sea lions on the Pacific Coast was described at length and the topography of the islands on which they live. The speaker also described several more recent trips which he had made into the northern parts of Wisconsin, made principally to obtain birds and accessories for bird groups in the Public Museum.

The lecture was illustrated by stereopticon slides prepared from negatives made by Mr. Ward on the various collecting trips to which he referred.

Milwaukee, May 9, 1907.

Meeting of the combined sections.

President Teller in the chair and Messrs. Barth, Brues, Clowes, Colles, Carpenter, Doerflinger, Graenicher, Russell and Sherman present.

Dr. Graenicher described a recent classification of entomophilous flowers and insects first proposed by Loew for the European Flora. He mentioned the several categories illustrating each by specimens of fresh flowers. He then showed the degree of mutual adaptation among the several classes which he compared with the results obtained by Loew in Europe.

Mr. Brues then exhibited two species of insects. One, *Ignotus anigmaticus*, was a peculiar beetle of very anomalous structure which has puzzled systematists since its discovery several years ago. The specimens exhibited had been found feeding on some dried Echinoderms in the Public Museum. This was the second time that the species has been collected, its original habitat being unknown, but probably the West Indies. The second was a new species of wingless fly belonging to the genus *Puliciphora*, recently bred from cattle tick eggs by the United States Department of Agriculture, and sent him for identification. Mr. Teller then exhibited some specimens of a rare fossil Echinoderm, *Ichthyechinus corbis*, from the Chicago formation of the Niagara limestone. After considerable discussion about these, the meeting adjourned.

OBSERVATIONS ON THE NESTING HABITS OF GORYTES CANALICULATUS, PACKARD

BY GEORGE P. BARTH.

While sojourning at Cedar Lake, Washington Co., Wisconsin, during the latter part of July of this year, my attention was attracted by a beautiful yellow-banded wasp busily engaged in performing its nesting labors among a large colony of *Aphilanthops frigidus*, an occasional *Bembex*, *Cerceris*, *Anacrabro ocellatus*, *Oxybelis*, leaf cutter bees and even an *Osmia*. All lived in perfect harmony on a little hill of sand not over twenty feet long and six feet wide located at the edge of a gravel pit bordering a wide, deep, though small ravine still in pristine state. An immense oatfield on the other three sides made this a secluded corner which received the full glare and heat of the sun during the greater part of the day.

It was a treat as well as a study to see the methods by which these busy workers accomplished their aim of procuring an abiding place wherein their young could develop undisturbed. *Aphilanthops* vigorously scratched, sending showers of sand to a distance of more than a foot with a rasping sound which could easily be heard at a distance of from ten to fifteen feet; restless *Anacrabro* diving into her burrow only to emerge again flying backwards to scatter broadcast a mass of sand grasped between her legs and body; *Bembex* with her angry hum when she attempted to pull out a pebble too large for even her strong mandibles; *Cerceris* digging away at a rate which caused her forefeet to resemble a blur of moving matter, while now and then *Gorytes* smoothed away her load of sand to make room for more.

Although the primary object of my visit to this hill was to become acquainted with *Anacrabro*, I found that it was still too early in the season for that interesting insect, as she had not begun to store her cells, and so turned my attention to the

worker whose habits, as far as I saw them, it will be my pleasant task to describe below. Unfortunately part of almost every day was marred by a shower of rain, or the conditions of the sky was such as is designated part cloudy in our weather reports.

The notes will be given just as they were entered in my field book at the time:

Gorytes begins her nest by scratching at the chosen spot with her forefeet, occasionally helping with the mandibles when a pebble or particularly hard spot is met, until she has loosened a small pile of sand when she backs out and smooths this away to some distance. Pebbles are grasped by the mandibles and carried a short distance and there dropped. After the burrow has reached a depth greater than the length of the wasp, the sand accumulates behind her and is then pushed out with the abdomen at the same time assisting with the legs as she backs out.

NEST NO. 1.

This nest was about one inch in depth when first seen at 5:25 P. M. July 14th. Activities were continued until nearly six o'clock, when the opening was closed from within. At 6:40 the nest was still closed and remained closed until I left as darkness fell, so the presumption was that labor had ceased for the night. It rained steadily during the morning of July 15th, and the nest was not visited until 4:00 P. M. It was still closed. The sand was blown away until the opening was free and the depth of the gallery tested with a grass stem. At 4:33:30 the wasp returned, carrying a leaf hopper. Although wide open, she instinctively began scratching at the entrance of the nest as if to clear it and then entered head foremost, carrying her prey. She came out at 4:42:20, closing the hole as she came, using mandibles and feet in the operation. She then turned around to examine the work but a *Formica subwenscens* running by disturbed her inspection, when she flew away a short distance and, upon the ant leaving, returned and proceeded to close more effectively with further material gathered by forelegs and mandibles from a radius of about one inch. After a short locality study in gradually widen-

ing circles departure took place at 4:11:00, leaving a smooth hill of sand over the entrance. Her further activities were as follows:

Returned at 4:55 with hopper. Opened the nest without dropping her prey.

Came out at 4:56. Closed the opening.

Flew away at 4:57:35. No locality study.

Returned at 5:17:15 with hopper, flying directly to the nest.

Entered at 5:17:38.

Came out at 5:17:55. Closed nest by scratching sand from a distance of about one inch.

Away at 5:17:59. No locality study.

Returned at 5:52:45 with hopper.

Entered at 5:52:57.

Came out at 5:53:30. Closed the nest.

July 16th. Part cloudy. Observations begun at 8:45 A. M.

Wasp came at 9:14.

Away at 9:14:40. A few scratches to close. No locality study.

Returned at 9:40 with hopper.

Entered at 9:40:15.

Came out at 9:40:20. A few scratches to close.

Away at 9:40:30. No locality study.

Returned at 9:50:45 with hopper.

Entered at 9:50:55.

Came out at 9:51:10. A few scratches to close.

Away at 9:51:14. No locality study.

Returned at 10:00:25 with hopper.

Entered at 10:00:30.

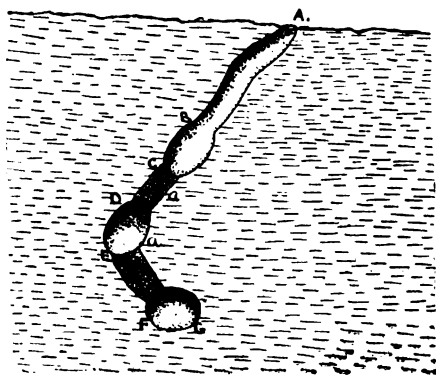
Came out 10:00:40. Began filling the entrance by scratching towards herself while still in the hole.

Away at 10:00:50.

The wasp had not returned by 11 o'clock, so thinking the nest complete I excavated. At 11:15 she returned with a hopper and sat about eighteen inches away watching the destruction going on. I then caught her.

The entrance of the nest was 0.4 cm. in diameter and widened

to 0.8 cm. one inch down. Whole nest following the curve A to G., 11 cm.; A to B., 4 cm.; C to D., 1.5 cm.; E to F., 2 cm.; a. a.—firmly packed sand. The cells and gallery were practically in the same plane, cell 2 being about 1 cm. lateral to cells 1 and 3.



NEST NO. 1.

CELL 1. Contained eight leaf hoppers, seemingly placed haphazardly in the cell. The egg was on the left side of the thorax of a hopper in the middle of the cell, beginning at the neck and running parallel to the hopper's body at the edge of the wing. Cell practically spherical in shape, 0.7 cm. in diameter.

CELL 2. Egg shaped; 1.3 cm. long and 0.8 cm. in its greatest diameter; 14 leaf hoppers. No egg found.

CELL 3. 1.2 cm. long and 0.9 cm. in diameter; 3 leaf hoppers. No egg found.

NEST NO. 2.

July 16th. Wasp came at 2:54 with a hopper. A locality study of considerable care was made both before entering and on leaving, probably due to the fact that I had disturbed the surface to some extent in excavating an *Anacrabro* nest three inches away. The entrance was under a small, round stone and

the gallery descended at a very slight angle. The wasp left at 2:54:10 without closing the entrance. The nest was probably abandoned, as I did not see her again during my stay.

NEST NO. 3.

July 16th, 4:35 P. M. This nest was already quite deep when discovered, but the wasp was still digging. The entrance was in the side of the hill which had a slant of about 45°.

July 17th. Warm and dry. At 9 A. M. the nest was closed by a small hill of sand. This was blown away, completely exposing the entrance. At 9:18:30 the wasp came carrying a hopper and went directly into the nest seemingly undisturbed by the fact of the nest being open.

Came out again at 9:18:50 and closed by scratching sand from a radius of about one inch. Flew away at 9:20. Nest smoothly covered.

Returned at 9:50:7 with hopper.

Entered at 9:50:10.

Came out at 9:50:25. Closing by a few scratches.

Away at 9:50:30. No locality study.

Returned at 10:45:30 with hopper. Rested on sand near the nest.

Entered at 10:45:55.

Came out at 10:46:5. Head first.

Away at 10:46:10. No locality study.

Returned at 11:12:10 with hopper.

Entered at 11:12:12.

Came out at 11:12:25.

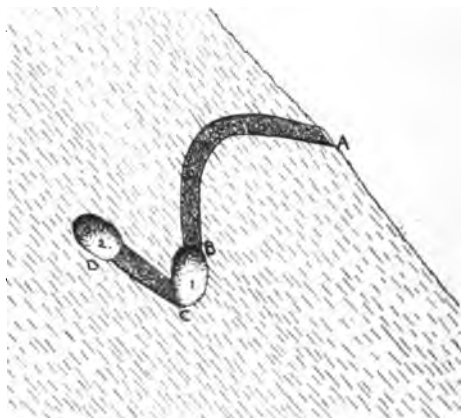
Away at 11:12:32. No locality study.

At 11:21:20, a *Nysson fidelis* (Cres.) entered the nest by quickly scratching it open. Came out at 11:21:48, closing the opening much less perfectly than the *Hoplysis* and flew away.

At 11:45:20 the *Gorytes* returned with a hopper and entered at 11:45:22, seemingly not disturbed by the fact of the *Nysson* having been there. 12:2:10 looking out of the nest. At

12:13:10 began to close the nest while still part way in the gallery scratching considerable quantities of material into the nest. She finally closed by taking material from around the nest, occasionally stamping it down with her abdomen. This she continued until a perfectly smooth surface was presented. Believing this careful closing to indicate the completion of the nest, the wasp was caught as she was flying away at 12:18.

As far as could be determined the entrance was but slightly narrower than the gallery. Cell 1 was 2 cm. lateral to cell 2, which again occupied the same plane as the entrance. A to B, 8 cm. Rather loosely packed with sand. C to D, 2 cm. also packed.



NEST NO. 2.

CELL 1. 1.3 cm. long and 0.8 cm. in diameter. Regularly oval; 12 leaf hoppers. The egg was placed on the right side of the thorax parallel with the edge of the wing, but starting slightly posterior to the neck of the hopper.

CELL 2. Seven hoppers and an egg which showed beginning larval segmentation. Placed on the right side of the thorax of the hopper as in cell 1.

The Nysson egg was not found.

NEST NO. 4.

July 17th, 1907. Nest found at the base of a tussock of grass. Wasp came at 9:47:10 with a hopper; came again at 9:54:10 with hopper.

Entered at 9:54:45.

Came, 10:21:00, with hopper; entered, 10:21:20; out, 10:21:32; away, 10:21:45; closing rather careful. Locality study none.

Came, 10:28:28, with hopper; entered, 10:28:35; out, 10:28:55; away, 10:29:06. A few scratches. Locality study none.

Came, 10:32:28, with hopper; entered, 10:32:37; out, 10:32:40; away, 10:33:00. A few scratches. Locality study none.

Came, 10:48:10, with hopper; entered, 10:48:15; out, ———; away, 10:48:20. A few scratches. Locality study none.

Came, 11:13:10, with hopper; entered, 11:13:16; out, 11:14:00; away, 11:14:02. A few scratches. Locality study none.

Came 11:40:00, with hopper, and entered an *Aphilanthops frigidus* nest which was in the building close beside its nest. Seemed much puzzled by the change in the surface which the ejected sand of the *Aphilanthops* made. Hunted around, scratching here and there, and finally found the entrance.

Returned to post of observation at 1 P. M. Nest was very well closed.

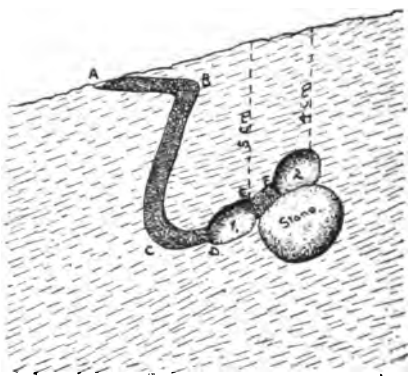
Came, 1:59:30, with hopper; entered, 2:00:00; out, 2:2:00; away, 2:2:20. Rather careful closing. Locality study none.

While the wasp was in the nest a *Nyssus fidelis* (Cres.), identified for me by Mr. Viereck) started to enter the open nest but, becoming aware of the presence of the owner, backed out and flew to a distance of a foot, there resting quietly on the sand and

watching. At 2:30:00 it rapidly opened the nest and entered, remaining till 2:10:00, when she came out again and closed the entrance. She was then caught.

July 18th. The nest was excavated this morning. It ran northeast one and one-half inches, down and southeast by south two inches, east one inch to cell.

The gallery was regularly round, with smooth inner surface, the entrance being about the same size as the passage.



NEST NO. 4.

CELL. 1. Was regularly oval, as shown in the drawing, its length being about 1 cm., and greatest diameter 0.7 cm. Contained 9 leaf hoppers. The egg was on the thorax slightly below and parallel to the edge of the left wing, beginning at the neck. On the floor of the cell, about one-third from the entrance, another egg was found unattached. In shape it was similar to the wasp egg, but smaller and the surface less shining; slightly curved.

CELL. 2. Eight hoppers, irregularly round and partially back of the stone. The egg was placed in a position on the hopper like that in the other cell.

NEST NO. 5.

July 20th, 1907. Wasp came at 10:27:00 A. M., with a hopper. Left at 10:27:40. after carefully closing the entrance. Returned at 11:16:20 with a hopper. Entered at 11:16:35, after resting about a foot from the nest. Came out at 11:17:15 and flew away at 11:17:30, with no locality study.

Rain set in at noon and continued all the next day, and as I was compelled to return to the city on an early train, July 22nd, this closed my observations.

GENERAL REMARKS.

The prey of the wasp seems to be exclusively leaf hoppers of the species *Cyrtolobus fenestratus* Fitch and *Atyma inornata* Say in all stages from the nymph to the adult as found in the cells. They were not closely packed and lay at all angles to each other as though carelessly thrown into place. None of the hoppers responded to stimulation with fingers or forceps, so presumably they were stung to death.

In all cases the entrance was opened just sufficiently to allow the wasp to slip in and careful watching failed to give any evidence of a shifting of hold on the prey as the wasp carried it in. This was carried tightly grasped about the neck or anterior thorax by the middle legs and, whether the wasp walked or flew, was never dropped. The wasp always entered the cell head foremost, carrying the hopper with her. The entrance was completely closed when the wasp left, the little work required to produce this being due to the small opening which the wasp made to enter, this being often but one-half of the actual size of the door.

The quickness with which the insects were able to return with prey was due no doubt to a plentiful supply in the densely overgrown ravine close by, as the wasps seemed invariably to go and come from that direction. The presence of an observer seemed to have no disturbing influence on her actions, as very frequently I sat within a few feet of the nest with an umbrella over my head for protection against the heat of the sun.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. V.

BY CHARLES T. BRUES.

FAMILY BETHYLIDAE.

Goniozus hortorum sp. nov.

Female. Length 2.25 mm. Black; antennæ, except apex, pale yellow, legs piceous, the anterior pair and all the tarsi brownish-yellow. Head sub-shining, shagreened and with scattered large punctures; one and one-half times as long as wide. Face with a median carina between the antennæ that extends just above the level of the lower eye-margin, and a lateral one of the same extent on each side above the antennæ. Seen from above the head is three times as long as the eyes. Eyes bare, ocelli in a small triangle near the posterior margin of the head. Antennæ 13-jointed, extending only a short distance beyond the vertex; slender, with the joints submoniliform. Scape stout, two times as long as thick. First flagellar joint only one-half as long as the pedicel, which is a little longer than the second; following subequal, becoming distinctly moniliform before the tip. Mandibles varying from piceous to black. Palpi piceous, malar space very short. Pronotum and mesonotum sculptured like the head, the former evenly narrowed in front, and about two and one-half times as long as the mesonotum, the latter almost two times as wide as long. Scutellum shagreened, distinctly longer than the mesonotum and as broad as long, separated from the mesonotum by a very delicate suture and with a short oblique linear fovea on each side basally. Metanotum strongly shagreened laterally, but smooth and polished medially; the entire lateral margins and the lower edge of the posterior slope margined, but otherwise without carinæ, except for a trace of one laterally at the top of the posterior edge. It is slightly longer than the mesonotum and scutellum together, with the posterior face coarsely shagreened. Abdomen oval, polished, as long or slightly longer than the head and thorax together; second and following segments broadly emarginate on their posterior margins. Legs stout but not at all spinose. Claws bifid, with a long slender inner tooth. Wings hyaline, both stigmata piceous, the stigma somewhat but only slightly larger than the parastigma. Basal nervure angularly broken, but without

any stump of a vein, its upper section one-half the length of the lower. Two basal cells defined by pale yellow nervures. Marginal cell open, the radial vein three times as long as the stigma, separated by its own length from the wing tip.

Three females bred by Prof. H. A. Surface from the larva of a microlepidopteron folding the leaf of the Apple; Floradale, Pa.: August 16, issued September 7.

As can be seen from the following table, it is most closely related to *Goniozus foecolatus* Ashmead.

NORTH AMERICAN SPECIES OF GONIOZUS.*

- | | |
|---|---------------------------|
| 1. Metanotum smooth medially, without trace of a median carina. | 2 |
| Metanotum with a delicate median carina; stump of cubital vein well developed..... | platynotæ Ashm. |
| 2. Head unusually large; legs piceous; tips of tibiæ and tarsi pale; stump of cubital vein very small..... | megacephalus Ashm. |
| Head of normal size..... | 3 |
| 3. Stump of cubital vein as long as the upper section of the basal nervure; legs, except tarsi, black; wings hyaline; head without larger punctures interspersed..... | clarimontis Kieff. |
| Stump of cubital vein much shorter, often scarcely developed.. | 4 |
| 4. Abdomen as long the the head and thorax together..... | 6 |
| Abdomen shorter than the head and thorax together..... | 5 |
| 5. Legs including coxæ yellow..... | hubbardi Howard. |
| Legs piceous, with trochanters, tibiæ and tarsi more or less yellowish | columbianus Ashm. |
| 6. Wing veins piceous or brown..... | 7 |
| Wing veins testaceous or honey-yellow..... | 9 |
| 7. Head of female one and one-half times as long as wide, with more or less distinct scattered punctures..... | 8 |
| Head of female two times as long as wide, smooth and impunctured | politus Ashm. |
| 8. Metanotum not margined laterally, parastigma as large as the stigma | longiceps Kieff. |
| Metanotum margined laterally, stigma larger than the parastigma | occipitalis Kieff. |

* Exclusive of West Indian and Mexican species, and also of those with a closed discoidal cell. These latter are more properly to be regarded as forming the Genus *Parasicerola* Cameron.

9. Stump of cubital vein distinct; wings subhyaline, with black stigma and honey yellow veins.....**foveolatus** Ashm.
 Stump of cubital vein obsolete, wings hyaline, with piceous stigma and pale yellow veins.....**hortorum** sp. nov.

Phorbas longicornis sp. nov.

Male. Length 2.25 mm. Black; the anterior trochanters and all knees pale yellow; tibiae and tarsi fuscous. Wings nearly hyaline, iridescent, stigma and marginal vein fusco-piceous. Head twice as wide as thick, the occiput evenly arcuated and excavated behind. Ocelli distinctly in a triangle, the anterior one being its own diameter in front of the lateral ones. Eyes oval, pubescent. Clypeus strongly protuberant below. Mandibles pale, with black tips, palpi pale. Head everywhere finely shagreened and thinly whitish: pubescent. Antennae long and slender, almost as long as the body. Scape and pedicel short, the former a little the longer, the pedicel two times as long as thick; first six flagellar joints subequal, growing gradually shorter, the first fully five or six times as long as thick. Prothorax scarcely visible from above, but attaining the tegulae on the sides. Mesonotum broad, shining, faintly shagreened, with two very fine parapsidal furrows. Scutellum large, subconvex, shining, with a cross-furrow at its base. Metathorax about one and one-half times as long as wide, obliquely truncate behind, its surface regularly and finely rugulose. Abdomen small, flattened, smooth and shining, as long and about as broad as the thorax. Wings large, stigma very narrow, obliquely truncate basally, and prolonged into a thickened postmarginal vein apically. Radial cell nearly closed. Two basal cells indicated by yellow veins. No trace of any discoidal cells, although the subdiscoidal nervure is distinct nearly to the margin of the wing. Both pairs of wings distinctly ciliated. Legs slender, pubescent, the tibiae each with a small very slender spur.

Described from one male sent me for identification by Prof. H. A. Surface of Harrisburg, Pa. It was bred by him from a cocoon thought to be that of a species of microlepidopteron collected at Saegerstown, Pa., January 30. As all members of the group are parasites of leaf-hoppers, feeding externally and later spinning their own cocoons, it is probable that the parasite's own cocoon was mistaken for that of a moth.

The present species differs from the only other described species by its long antennæ, and by the presence of a subdiscoidal vein in the wing.

I think it undoubtedly belongs to Ashmead's genus *Phorbas*, although it will not run to it in Kieffer's recent table (*Genera Insectorum Fascicle 54*, p. 12, 1907). He has placed *Phorbas* in his sub-family Dryininæ, characterized by the short pronotum which does not attain the tegulæ on the sides. Ashmead, in his diagnosis of *Pharbas*, says, "Thorax as in *Aphelopus*, but without distinct parapsidal furrows, the prothorax only slightly visible from above." In *Aphelopus* the prothorax attains the tegulæ. I think, therefore, that Kieffer has incorrectly placed the genus, and that it undoubtedly falls near *Labeo*. It seems probable to me also that Perkins' *Eukolbelcia* is a synonym of *Phorbas*.

FAMILY SCELIONIDÆ.

Macroteleia surfacei sp. nov.

Female. Length 4.5 mm. Black; the legs more or less pale rufous. Wings hyaline. Head quadrate, slightly broader than thick. Its surface shagreened and covered with moderately thick regular large punctures. Eyes oval, bare, ocelli in a triangle, the lateral ones as far from the eye-margin as from the median ocellus. Mandibles rufous, with black teeth. Antennæ 12-jointed; the scape about one-half the length of the flagellum. Scape, pedicel and first four flagellar joints more or less rufous or brownish. Pedicel long, a trifle shorter than the first flagellar joint which is about four times as long as thick. Second, third and fourth growing shorter, the fourth slightly longer than wide. Club six-jointed, black; slender, fusiform, the joints quadrate or slightly transverse, and all of nearly equal thickness, except the apical joint, which is more slender and a little longer. Occiput and cheeks margined behind. Mesonotum with well separated round punctures like those of the head, with distinctly impressed parapsidal furrows. Scutellum sculptured like the mesonotum, with a coarsely punctate frenalum at its base and a more delicate one at the apex. Metathorax very short, the metanotum scarcely visible from above, elevated into a transverse ridge anteriorly and rugulose behind, without raised lines. Abdomen long, acuminate, seen from the side is two and three-fourth times as long as the head and thorax

together, slightly depressed on the basal half and compressed apically. Its surface with moderately large regular punctures; the first segment also strongly striated and the second, fifth and sixth slightly so. Second segment one and one-half times as long as the first and equal to the third and sixth. Fourth and fifth equal, each three-fifths the length of the second. Venter finely punctate, weakly aciculated basally. Legs honey-yellow, or pale rufous, the tips of the middle femora, most of the posterior pair, and the apical tarsal joints infuscated. Coxæ black. Wings hyaline, stigmal vein slender, knobbed, one-half as long as the marginal. Postmarginal one-third longer than the marginal. Basal vein obsolete. The wings when folded reach to the base of the fifth segment.

Described from 10 female specimens reared during May by Prof. H. A. Surface from the eggs of a locustid: Chester, N. J.

This is the fifth species of the genus to be discovered within the United States, and may be distinguished from the others by the aid of the following table:

- | | |
|---|---------------------------|
| 1. Eyes bare | 2 |
| Eyes pubescent; legs, including coxæ, brownish-yellow; first and second abdominal segments about equal in length. | |
| | virginiensis Ashm. |
| 2. Flagellum of antennæ wholly or partly reddish-yellow..... | 3 |
| Antennæ, except scape, dark brown, marginal vein about two times as long as the stigmal..... | floridana Ashm. |
| 3. Wings fusco-hyaline, marginal vein one and one-half times as long as the stigmal..... | macrogaster Ashm. |
| Wings hyaline | 4 |
| 4. Head not margined behind, marginal vein one-third longer than the stigmal..... | punctata Kieff. |
| Occiput and cheeks margined behind, marginal vein almost two times as long as the stigmal..... | surfacei sp. nov. |

***Sparaisson gregarium* sp. nov.**

Female. Length 4 mm. Black; legs, except coxæ; mandibles and scape and pedicel of antennæ, honey-yellow. Head coarsely rugoso-reticulate, frontal ridge projecting one-half the diameter of the eye in front of the eye-margin. Seen from above, the head is as wide as thick, the frontal ledge one-half as wide as the front, rounded anteriorly, with a reflexed smooth margin. Face below the ridge arcuately transversely striated. Mandibles ferruginous. Antennæ 12-jointed.

black. the scape, except extreme tip and the pedicel ferruginous. Scape broadly dilated at the tip; pedicel two-thirds the length of the first flagellar joint; second to seventh slightly wider than long, the following growing more slender, but of equal length. Prothorax very closely and rather finely punctate in front. Pronotum and mesonotum deeply and coarsely punctate, the pronotum closely, but the mesonotum more sparsely apically toward the center. Parapsidal furrows vaguely defined by punctures, scapule punctate, with no trace of any groove. Scutellum with a punctate frenum, two times as wide as long, its surface coarsely punctate, the punctures much sparser toward the center. Postscutellum with a very short spine. Metanotum finely rugose, more or less distinctly areolated anteriorly, and with a V-shaped carina on each side, but no median one anteriorly. Mesopleura with a large smooth space, metapleura with a smaller one. Metanotum with its upper lateral angles produced. Abdomen elongate ovate, as long as the head and thorax, coarsely longitudinally striated above, except along the posterior margins of the segments which are smooth and polished. Apical segments more or less punctate; sutures crenulate. Venter sparsely and rather coarsely punctate. Legs weakly spinous, clothed with glistening hairs. Wings infuscated, the costal cell hyaline. Stigma separated from the submarginal vein; stigmal vein incurved, a trifle longer than the indistinct postmarginal one, with an imperceptible knob at the tip. Marginal vein indistinctly indicated, except at base and tip, where it is not visible.

Two females sent me by Mr. Nathan Banks. They were collected at Falls Church, Va., August 2.

This species can be readily distinguished by the pale legs from any other in our fauna, except *S. famelicum* Say, which, however, has hyaline wings.

The species of *Sparaison* so far discovered within the United States may be separated by means of the following table:

- | | |
|---|---------------------------|
| 1. Wings hyaline, scapulae with a distinct grooved longitudinal line, legs, except coxae, honey-yellow..... | famelicum Say. |
| Wings infuscated, scapulae without a distinct grooved line..... | 2 |
| 2. Legs, except coxae, honey-yellow, antennal scape, honey-yellow. | |
| | gregarium sp. nov. |
| Legs principally black, sometimes with the tibiae and tarsi lighter, antennae wholly black..... | 3 |

3. Abdomen smooth and polished except at the sutures.

pacificum Ashm.

Abdomen longitudinally rugose or striate..... 4

4. Metanotum rugulose medially, without a central carina..... 5

Metanotum with a distinct carina medially at the base; scapulæ punctate **graenicheri** Bruen.

5. Frontal ledge broad, on the same plane as the vertex, scapulæ impunctate **pilosum** Ashm.

Frontal ledge not so broad and not on the same plane as the vertex, more oblique..... **nigrum** Ashm.

Hadronotus robustus sp. nov.

Female. Length 1.7 mm. Entirely black; the tibiæ and tarsi dull rufous. Head large, considerably wider than the thorax, and three times as wide as thick, the occiput arcuately excavated; its surface coarsely rugose. Occiput above with a finely raised line, vertex without any smooth areas; lateral ocelli about their own diameter from the eye margin. Eyes bare. Facial excavation above the antennæ deep, transversely striated and margined by a raised line laterally. Antennæ 12-jointed, clavate, black, with the tip of the pedicel rufous. Pedicel and first flagellar joint of equal length, second distinctly shorter, third small, quadrate, club fusiform, not very stout, the joints slightly transverse. Mesothorax and scutellum coarsely rugose; no parapsidal furrows. Metathorax very short. Abdomen short, subglobose, about as wide and as long as the thorax; first segment deeply grooved and ribbed longitudinally near its base, apically rugulose. Second segment twice as long as the first, and one-third as long as wide, rugulose basally and microscopically so near the apex; third segment less than one-half as long as the second; fourth still shorter, both sculptured like the apical half of the second. Venter finely punctulate. Pleuræ rugose but still more or less shining. Legs black. knees, tibiæ and tarsi, except terminal joint, rufous. Wings hyaline, the venation yellowish brown. Marginal vein short, about one-half the length of the stigmal; postmarginal nearly twice the length of the stigmal.

Described from one female specimen collected by the writer at Austin, Texas.

The species is related to *H. insularis* Ashm. from Grenada, West Indies, and to *H. rugiceps* Ashm. from the United States. It differs from both in the relative lengths of the antennal joints and the segments of the abdomen.

FAMILY ICHNEUMONIDÆ.

***Orthopelma thompsoni* sp. nov.**

Male and female. Length 3.75-4.25 mm. Head and thorax black; legs in part and abdomen beyond the petiole reddish. Head broad, almost three times as wide as thick. Face distinctly narrowed below, more strongly so in the male. Clypeus with an impressed line near the anterior margin which is raised and weakly emarginate. Mandibles black, clypeus reddish in the male. Palpi pale. Antennæ short and rather stout, 18-19-jointed in the female and 22-jointed in the male. Flagellar joints decreasing in length apically except the last, which is twice as long as the preceding; first flagellar joint four times as long as thick, penultimate only slightly longer than thick. Surface of head shining, faintly punctate, more distinctly so on the occiput and cheeks. Eyes bare, elongate, twice as long as wide. Occiput and cheeks margined behind. Mesonotum finely punctate, no trace of parapsidal furrows. Scutellum with a depression anteriorly and strongly convex posteriorly. Metanotum areolated, all the areas separated and distinct. Abdomen with a long petiole, which is at least four times as long as broad; spiracles prominent, placed near the basal third; its surface finely rugose, with a carina on each side from the spiracle nearly to the tip of the segment. Following segments polished. Ovipositor as long or a little longer than the abdominal petiole, reddish, its sheaths narrow, black and nearly bare. Mesopleura polished, with a fovea near the center, margined behind and with a wide finely orenate furrow below. Legs moderately stout; pale ferruginous, hind femora except tip piceous, and hind tibiæ darker apically. Coxæ and first joint of hind trochanters black. Tegulæ pale yellow, abdomen, except petiole, bright ferruginous, the segments often with darker spots laterally behind, especially in the male. Wings hyaline, stigma and veins piceous, the former broad and paler at the base. Areolet open behind and small in position.

Described from numerous specimens bred by Prof. M. T. Thompson from the galls of *Rhodites rosæ* at Worcester, Mass. Most of the known species of the genus are parasites of various members of the genus *Rhodites*.

FAMILY BRACONIDÆ.

Helcon ferrugineus sp. nov.

Female. Length 9-10 mm. Ovipositor 7-9 mm. Entirely pale, ferruginous, tips of hind tibiæ and antennal flagellum except for pale annulus, piceous. Head large, transversely quadrate, about one-half wider than thick. Face irregularly rugose, antennal excavation with a median carina, sharp lateral margins and a few irregular striæ below; above immargined, polished and including the anterior ocellus. Antennæ setaceous, 35-jointed, piceous, the first two joints rufous. Flagellum with a whitish annulus that occupies about seven joints. The basal joints are long, four or five times as long as thick, while those after the annulus become much shorter, those nearer the apex being only one-half longer than thick. Head above and behind highly polished, occiput and cheeks faintly punctate. Vertex with a finely impressed longitudinal line. Eyes rather small, oval, about as broad as the cheeks. Mandibles slender, edentate, black at tips. Palpi pale rufous. Prothorax rugose, with a small strip above on the sides closely punctate; nowhere striate. Mesonotum shining, sparsely punctured; trilobed, the parapsidal furrows crenulate anteriorly; behind, the space between them is roughly rugose. Scutellum small, narrow, with a broad rugose depression at its base. Metathorax coarsely rugose reticulate, the reticulations defining rather irregularly six longitudinal carinæ on the posterior three-fourths. Metapleuræ more finely rugose. Abdomen as long as the head and thorax, claviform. First segment twice as long as wide at the tip, coarsely rugose punctate, with two prominent longitudinal carinæ on the basal half and a much less distinct median one on the posterior half. Second segment with sparse coarse punctures except along the median line and the posterior margin. Following segments smooth and polished. Legs slender, except the posterior femora which are thickened and furnished with a single stout tooth beneath near the apex. Hind tarsi, except terminal joint, whitish. Ovipositor ferruginous, its sheaths black and hairy. Wings hyaline, stigma and nervures ferruginous. Recurrent nervure received near the posterior third of the first cubital cell: second cubital cell narrowed above, only half as long on the radius as on the cubitus. Submedian cell scarcely longer than the median; subdiscoidal nervure inserted at the lower fourth of the discoidal nervure. Transverse median vein in hind wing not broken.

Two females from Fedor, Lee County, Texas, sent me by Rev. G. Birkmann.

This species is rather closely related to *H. dentipes* Brullé, but is evidently distinct. Although variable in color, the latter is always in considerable part black, and also differs in the sculpture of the prothorax and metanotum. The mesonotum of the present species is also more roughly sculptured, and the recurrent nervure in the wing inserted farther from the transverse cubitus.

***Calyptus collaris* sp. nov.**

Female. Length 2.5 mm. Ovipositor 2.8 mm. Black, the pronotum, mesonotum, coxæ and legs bright honey yellow. Wings hyaline. Head transverse, slightly more than twice as wide as thick. Face evenly convex, microscopically rugulose and whitish pubescent. Front, vertex, and occiput smooth, polished, and impunctured. Cheeks faintly shagreened. Mandibles and clypeus wholly ferruginous. Eyes rather small, elongate oval, one-half as long as the head height. Antennæ 26-jointed, black, the scape and pedicel more or less rufous. Second flagellar joint one-third longer than the first, five times as long as thick, following rapidly growing shorter, becoming quadrate near the apex. Ocelli large and prominent, in a small triangle. Pronotum rugose striate, smooth and polished near the lateral angles. Mesonotum impunctate or nearly so. Parapsidal furrows deep and crenulate, meeting before the scutellum. Scutellum piceous, with a broad fovea anteriorly, which is divided by a delicate median carina. Metanotum rugose, with two small triangular smooth basal areolas side by side anteriorly; a less distinct pentagonal areola behind these which gives off two delicate longitudinal carinæ. Abdomen as long as the thorax, with three visible dorsal segments; first segment as long as wide and longitudinally aciculated, with a pair of carinæ basally which converge behind. Second segment as long as the first and a little wider, finely aciculated; third smooth and polished. Legs and coxæ honey-yellow, the posterior tibiæ at tips and hind tarsi fuscous. Ovipositor rufous, its sheaths black, pubescent. Wings hyaline, stigma piceous, pale at the base, venation brownish testaceous. Recurrent nervure received beyond the apical third of the first cubital cell. Submedian cell distinctly longer than the median; second discoidal cell closed at apex, the subdiscoidal nervure interstitial; anal cell with no trace of dividing nervure. Transverse median vein in hind wing not broken.

Described from one female collected by Mr. Charles Schaeffer at Esperanza Ranch, Brownsville, Texas.

This resembles in color the West Indian *Calyptus thoracicus* Ashmead, but differs by its much smaller size, and in having only 26 joints instead of 35 joints to the antennæ.

FAMILY ALYSIIDÆ.

Acrisis americanus sp. nov.

Male. Length 1.75 mm. Thorax piceous, head, pleuræ, coxæ, legs, and second abdominal segment brownish-yellow. Wings hyaline. Head smooth and shining, faintly shagreened above; transversely quadrate, the temples rather narrow. Eyes moderately small, bare. Cheeks one-half as long as the greatest length of the eye. Antennæ slender, filiform, not quite as long as the body, about 18-jointed, the joints poorly differentiated and difficult to count; second to sixth joints about equal, each about four or five times as long as thick, following growing shorter. Palpi pale testaceous. Mesonotum shining, shagreened, trilobed, the parapsidal furrows deep anteriorly, approximated and less distinct posteriorly, where they become confused with some other longitudinal striate sculpture. Scutellum shagreened like the mesonotum, with a broad crenulated transverse furrow across the base and a semi-circular fovea just before the center. Metathorax finely rugulose, not at all areolated. Pleuræ rugulose above and shagreened below; dark above, but pale yellowish below on the mesopleuræ. Abdomen ovate, sessile, the first segment piceous, a little longer than wide, its base two-thirds as wide as the apex, surface finely aciculate; second segment aciculate, pale yellow, longer than the first and twice as wide. Following segments indistinctly separated, shining piceous. Legs moderately stout, the posterior femora strongly incrassated, their tibiæ slightly so. Apical joint of all tarsi piceous. Wings hyaline, stigma and venation very pale fuscous. Two cubital cells; first cubital, first discoidal and submedian cells all distinctly separated from one another. Radius and cubitus obsolete beyond the first transverse cubitus; subdiscoidal nervure distinct at its base.

Described from a single male sent me by Dr. M. T. Thompson. It was bred by him from an unidentified gall collected at Worcester, Mass.

This is the first American species to be discovered, and the second member of the genus. To judge from the diagnoses of Förster, Ashmead and Szépligeti, it is a typical representative of the genus.

Public Museum, Milwaukee, Wis.
June 10, 1907.

BRIEFER ARTICLES.

THE OCCURRENCE OF THE SYRPHID FLY, *CONDIDEA LATA* COQ., IN WISCONSIN.

It may be of interest to record the fact that a female specimen of *Condidea lata* Coq. was collected from the flowers of the Sumach, *Rhus glabra*, at Cedar Lake, Washington Co., Wisconsin, July 15, 1907. A male was taken at the same place July 19. These were the only two specimens obtained by two collectors in ten days, although flies were very abundant on the plants during that time. A few days later, Mr. Henry L. Ward obtained a single specimen from Little Cedar Lake, in the same county. The species was first described by Coquillett from North Saugus, Mass., (Can. Ent., Vol. 39, p. 75, March, 1907) and later mentioned by Jones (Journ. N. Y. Entom. Soc., Vol. 15, p. 95, June, 1907) as occurring in several parts of Nebraska. The sudden appearance of this conspicuous fly in a place which has for years been collected over by entomologists is, therefore, of considerable interest.

GEORGE P. BARTH.

CORRECTION.

Mr. Editor:

Though I requested the sending of proof for my article in the last (April) Bulletin, the printer sent me neither proof sheets, nor my MS., nor the plates. I regret to find the following corrections necessary:

- Page 134. Quarternary should be Quaternary.
- Page 134. Linnean should be Linnéan.
- Page 134. Sexcommunes should be six communes.
- Page 134. Madaleunéenne should be Madelainéenne.
- Page 134. Monstérienne should be Moustérienne.
- Page 135. The same as the last two.
- Page 135. Acheulléenne should be Acheuléenne.
- Page 136. fine should be firm.

The French adjectives frequently cause confusion on the part of English writers and printers who have not studied French grammar and do not know that and why the feminine form differs from the masculine.

I propose to English writing archeologists that they apply the English "ian" to the French name; it will always fit both genders and numbers in English.

Chelléen and Chelléenne are the masculine and feminine forms derived from Chelles, the name of a prehistoric station in the valley of the Marne river, about 11 miles nearly due east of Paris. Let us write the derived adjective *Chelitan*, which is plain English for both of the above adjectives and always correct for the masculine, feminine, singular and plural forms:

Likewise *Acheulian*, from St. Acheul (gravel beds in the valley of the Somme river);

Mousterian, from Le Moustier, the cavern near the bank of the very interesting Vezère river, a tributary to the Dordogne;

Solutrian, from Solutré, a rock shelter near Macon in the valley of the Saône river, some 50 miles almost due west from Geneva.

Madelainian, from La Madelaine, a rock shelter also on the Vezère, only a short distance below Le Moustier.

If my suggestion is adopted, it will save many who read or write on French archeology doubts and vexation.

You will oblige me by causing proof sheets of the above to be sent me for revision with my MS.

Yours truly,

C. H. DOERFLINGER.

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 5, New Series.

DECEMBER, 1907

No. 4

PROCEEDINGS.

Milwaukee, Sept. 26, 1907.

Regular monthly meeting of the Society.

President Teller in the chair and about fifty persons present.

The name of Mrs. E. Ruemmelin was proposed for membership and she was elected by the board of directors.

There being no further business Prof. I. N. Mitchell of the State Normal School spoke on "Burbank's Work With Plants." He described the early life of Mr. Burbank, his first experiments in plant breeding and the difficulties which he encountered at the beginning of his work. After referring to the peculiarly acute observation of Mr. Burbank and his fine and discriminating methods of plant selection, the speaker turned to a consideration of a number of the more important new varieties of plants which Mr. Burbank has produced, illustrating his remarks by means of stereopticon pictures.

After the lecture the meeting adjourned.

Milwaukee, Oct. 10, 1907.

Meeting of the combined sections:

President Teller in the chair and Mrs. Ruemmelin, Messrs. Brues, Colles, Edwards, Finger, Graenicher, Landau, Monroe, Russell and Ward present. Mr. Colles exhibited some rocks and minerals from Northern Ontario. Among them was a fine specimen of dendritic silver, probably deposited from solution; some cobalt bloom and some glaciated slate.

Mr. Monroe exhibited specimens of asters collected in September in the east. These included the following forms: *Aster divaricatus*, L., and varieties; *A. Claytoni* Burg; *A. undulatus* L., and variety; *A. patens*, L., and *A. acuminatus* Michx.; all from western Massachusetts or Connecticut; *A. ericoides* L. from western Connecticut and *A. eri-*

coides pilosus (Willd.) from northern Ohio. He also exhibited in connection with the two last, specimens of *A. faxoni* Porter and *A. prin-glei* Gray, the former from northeastern Illinois, the latter from central Wisconsin. Mr. Monroe knew of no reason why the species above named should not all occur in Wisconsin, but he had never found the New England species in this state.

The members were very much interested in Mr. Monroe's exhibition and there was a considerable amount of discussion concerning certain species.

The meeting then adjourned.

Milwaukee, Oct. 24, 1907.

Regular monthly meeting of the Society.

Vice President Ward in the chair and 47 persons present.

The names of Mr. Charles B. Weil, 286 Knapp St.; Dr. Geo. W. C. Meyer, Oconomowoc, Wis.; Robert W. Martin, Jr., 3107 Cedar St., and Miss Alice Childs, East Side High School, were proposed for active membership in the Society, and they were elected at the directors' meeting following.

There being no further business, Mr. Howland Russel addressed the meeting on "A Visit to Linnæus," a retrospection on the life, home and character of the great pioneer naturalist gleaned from the writings of his contemporaries.

Mr. Russell gave a brief description of the personality of Linnæus, followed by a biography considering the more important epochs in his life with his achievements during each. At the close he pointed out the immense amount of work accomplished by Linnæus and its place as the basis of all present systematic botany and zoology. After some discussion on the part of various members the meeting adjourned.

Milwaukee, Nov. 14, 1907.

Meeting of the combined sections.

President Teller in the chair and about 50 persons present.

Mr. Colles spoke on the origin and deposition of the Principal Ores of Copper and its extraction.

The speaker described the most important ores of copper and classified them according to their chemical constitution. He described the manner in which ores are deposited, more particularly their relation to watery solutions, their geographical distribution and abundance. He also described the methods of extracting the metal from several of the more important types of ores. After he had finished some of the members joined in a short discussion on certain

points. Mr. Brues then exhibited a series of plants collected by the Museum expedition into northern Wisconsin during the past summer. He also showed a number of lantern slides illustrating the general aspect of the localities examined by the expedition.

The meeting then adjourned.

Milwaukee, Nov. 21, 1907.

Regular monthly meeting of the Society.

President Teller in the chair and about 60 persons present.

Dr. Geo. W. Peckham spoke on Recent Additions to Our Knowledge of the Habits of Wasps. The speaker described the wonderful stinging instincts of certain wasps and then showed the advancing steps in the evolution of such instincts as illustrated by living species in different families. He was followed by Dr. S. Graenicher, who discussed the habits of bees from the standpoint of recent discoveries. He dealt particularly with the locality and direction senses so frequently attributed to certain Hymenoptera. The recent consensus of opinion seems to be that these instincts are largely built up on individual experience and visual memory of objects whose position has to be learned by the bees.

The meeting then adjourned.

CHECK LIST OF THE FLORA OF MILWAUKEE COUNTY.

By HOWLAND RUSSEL.

The following list is, of course, mainly a compilation of the two lists of W. M. Wheeler, published in April, 1888, and April '89, with those of W. T. Bennetts, published July, 1900, and Jan. 1902, all of which were issued as bulletins of this society. To them have been added the names of such species as have been reported since the last of those lists was published. The generic and specific names used in those lists have been altered, wherever necessary, to bring them in accord with the latest authorities. There are several species given in the old lists which probably were never found in this county, but were so recorded as a result of imperfect identification. But, as this cannot be conclusively proven, these names have been included in the present list, although those plants are not now found in the localities mentioned. There are others reported from localities the character of which has so changed that the species recorded are no longer found there, although they may perhaps grow elsewhere in the county. This is notably the case with those plants given as found in "Larkins Tamarack Swamp" (Sec. 1 Town of Greenfield.) This swamp has entirely disappeared, the trees have been cut away, the soil drained and the entire tract divided into vegetable gardens, so that there is now practically no trace of the original flora. The same is true of one or two localities from which species were reported by Rev. T. A. Bruhin. Some of these species, it may be confidently stated, no longer grow in the county. The present list is doubtless more or less incomplete in several ways, for new species are constantly being added to our records as certain groups of plants and certain localities are more carefully studied. Except in the neighborhood of the lake, the extreme Northern and Southern parts of the county have received very little attention or study, and there are but few records from

these districts. The increase in facilities for reaching them, by means of electric cars, will probably add to our acquaintance with their flora. So, too, there are doubtless many in the city who are interested in botany and who could greatly aid in making a more complete plant census, if they would but report the results of their studies where they could be properly recorded. New plants also are added to our flora by the introduction of seeds, brought here in rubbish and waste materials. The list is, however, as complete as our present knowledge of the flora of the county makes possible.

In this list the arrangement of families is that given by Engler and Prantl; the nomenclature is that adopted, so far as completed, by the editors of the new Gray's Manual, which is soon to be published. Where the names so given differ from those used in the second edition of Britton's Manual, the latter are inserted as synonyms, printed in italics. There are a number of generic and specific names which are liable to still further change to bring them in full accord with the rules of nomenclature adopted by the Vienna Botanical Congress, but these changes have not as yet been fully decided upon, nor are American botanists agreed as to the acceptance of this code.

In the genus *Cratægus* the names of the original species, from which Prof. Sargent has made numerous new species, are here given as synonyms, although not strictly such.

The editors of the new Gray's Manual have very kindly given a great deal of time and labor in so correcting the names in the list as to bring them up to date. Thanks are also due to Dr. S. Graenicher, Mr. Wm. Finger, Dr. H. V. Ogden and Prof. E. J. Hill of Chicago for the great assistance they have given in the preparation of this list.

OPHIOGLOSSACEÆ.

Botrychium virginianum (L.) Sw. *Botrychium*.

Throughout county. Common.

OSMUNDACEÆ.

Osmunda regalis L. Royal Fern.

Throughout county. Locally abundant.

O. cinnamomea L. Cinnamon Fern.

Common near St. Francis and locally throughout county.

O. Claytoniana L. Clayton's Fern.

Throughout county. Locally abundant.

POLYPODIACEÆ.

Adiantum pedatum L. Maiden-hair Fern.

Throughout county. Common.

Pteris aquilina L. *Pteridium aquilinum* (L.) Kuhn.

Throughout county. Occasional.

Cryptogramma Stelleri (Gmel.) Prantl. Rock-brake.

In Town of Franklin.

Asplenium Filix-femina (L.) Bernh. Lady Fern.

Throughout county. Common.

Camptosorus rhizophyllus (L.) Link. Walking-fern.

Menomonee Valley. Very rare. Reported from Town of Franklin.

Aspidium Thelypteris (L.) Sw. *Dryopteris Thelypteris* (L.) Gray.

Shield Fern. Sec. 27, Oak Creek. Abundant.

A. cristatum (L.) Sw. *Dryopteris cristata* (L.) Gray.

Throughout county.

A. spinulosum (O. F. Müller) Sw. *Dryopteris spinulosa* (Retz.) Kuntze.

Sec. 5 Greenfield. Abundant.

A. spinulosum var. *intermedium*. D. C. Eaton. *Dryopteris spinulosa*

intermedia (Muhl.) Underw. Sec. 27, Town of Lake.

Cystopteris bulbifera (L.) Bernh. *Filix bulbifera* (L.) Underw.

Bladder Fern. Menomonee Valley, and in Sec. 29, Town of Milwaukee.

C. fragilis (L.) Bernh. *Filix fragilis* (L.) Underw.

Throughout county. Common.

Onoclea Struthiopteris (L.) Hoffm. *Mateuccia Struthiopteris* (L.)
 Todaro. Ostrich Fern. Wauwatosa.

O. sensibilis L. Sensitive Fern.
 Throughout county. Locally abundant.

EQUISETACEÆ.

Equisetum arvense L. Field Horse Tail.
 Everywhere. Common.

E. sylvaticum L. Throughout county. Occasional.

E. fluviatile L. Menomonee Valley. Occasional.

E. hyemale L. Scouring-rush.
 Throughout county. Locally abundant.

E. variegatum Schleich.
 Lake shore and Milwaukee River. Common.

LYCOPODIACEÆ.

Lycopodium lucidulum Michx. Club-moss.
 Near New Coeln.

L. clavatum L. Running Pine.
 Near New Coeln.

PINACEÆ.

Pinus strobus L. White Pine.
 Found sparingly along lake shore from Whitefish Bay to
 northern limit of county.

Larix laricina (Du Roi.) Koch. Larch. Tamarack.
 Confined to a few small unreclaimed swamps throughout
 county. Formerly abundant.

Thuja occidentalis L. Arbor Vitæ.
 Not uncommon along lake shore, also in a few scattered
 localities.

Juniperus communis L. Common Juniper.
 Found sparingly along lake shore bluffs.

J. communis var. **depressa** Pursh. *J. nana* Willd. Low Jupiter.
 More or less common throughout county, especially so near
 lake.

J. virginiana L. Red Cedar.
 Occasional.

J. horizontalis Moench. *J. Sabina* L. Shrubby Red Cedar.
 Reported by T. Bruhin. Not found now in county.

TYPHACEÆ.

- Typha latifolia** L. Broad-leaved Cat tail.
Locally common.

SPARGANIACEÆ.

- Sparganium eurycarpum** Engelm. Broad Fruited Bur-reed.
Occasional throughout county.
- S. simplex** Huds. Simple-stemmed Bur-reed.
Along the Kinnickinnic River.

NAIADACEÆ.

- Potamogeton natans** L. Common Pondweed.
Common.
- P. amplifolius** Tuckerm. Large-leaved Pondweed.
Collected in county by Dr. H. E. Hasse.
- P. Nuttallii** Cham. and Sch. Nuttall's Pondweed.
Collected in county by Dr. H. E. Hasse.
- P. foliosus** Raf. Leafy Pondweed.
Not uncommon.
- P. diversifolius** Raf. Rafinesque's Pondweed.
Collected in county by Dr. H. E. Hasse.
- P. pectinatus** L. Fennel-leaved Pondweed.
Reported by T. A. Bruhin from lake shore.

JUNCAGINACEÆ.

SCHEUCHZERIACEÆ.

- Triglochin palustris** L. Marsh Arrow-grass.
Locally along lake shore north of city. Not common.

ALISMACEÆ.

- Alisma Plantago-aquatica** L. Water Plantain.
Abundant.
- Sagittaria latifolia** Willd. Broad-leaved Arrow-head.
Throughout county. Common.
- S. rigida** Pursh. Sessile-fruited Arrow-head.
Collected in county by Dr. H. E. Hasse.

HYDROCHARITACEÆ.

VALLISNERIACEÆ.

Elodea canadensis Michx. *Philotria Canadensis* (Michx.) Britton.
Water-weed. Common.

Vallisneria spiralis L. Tape grass.
In Milwaukee River in northern part of county.

GRAMINEÆ.

Andropogon scoparius Michx. Broom Beard-grass.
Near rolling mills in Bay View.

A. furcatus Muhl. Forked Beard-grass.
In southwestern part of county.

Digitaria humifusa Pers. *Syntherisma linearis* (Krock.) Nash.
Small Crab-grass. Town of Franklin.

D. sanguinale (L.) Scop. *Syntherisma sanguinalis* (L.) Dulac.
Large Crab grass. Near New Coeln.

Echinochloa crus-galli (L.) Beauv. Barnyard-grass.
Not uncommon.

Panicum capillare L. Witch-grass.
Common everywhere.

P. dichotomum L. Forked Panicum.
Near New Coeln.

P. Porterianum Nash. Porter's Panicum.
In Wauwatosa and along banks of Milwaukee River, near city limits.

Setaria glauca (L.) Beauv. *Chaetochloa glauca* (L.) Scribn.
Yellow Fox-tail. Locally common.

S. viridis (L.) Beauv. *Chaetochloa viridis* (L.) Scribn.
Green Fox-tail grass. Menomonee Valley and other localities.

Cenchrus tribuloides L. Bur-grass.
Southern part of Bay View.

Zizania aquatica L. Wild Rice.
Common in the Menomonee Valley.

Leersia virginica Willd. *Homalocenchrus Virginicus* (Willd.) Britton.
White-grass. Common.

L. oryzoides (L.) Sw. *Homalocenchrus oryzoides* (L.) Poll.
Rice Cut-grass. Common.

Phalaris arundinacea L. Reed Canary-grass.
In the Menomonee Valley and north of New Coeln. Bruhin.

P. cananariensis L. Canary-grass.
Found in several places in the city.

Hierochloe odorata (L.) Wahlenb. *Savastana odorata* (L.) Scribn.
Holy grass. Occasional in the Menomonee Valley.

Stipa spartea Trin. Porcupine grass.
Southern part of Bay View.

Oryzopsis asperifolia Michx. White-grained Mountain Rice.
Southern part of county.

Millium effusum (L.) Trin. Meadow Muhlenbergia.
Town of Lake.

Muhlenbergia mexicana (L.) Trin. Meadow Muhlenbergia.
Occasional in Wauwatosa.

M. sylvatica Torr. Minnesota Muhlenbergia.
Wauwatosa.

Brachyelytrum erectum (Schreb.) Beauv. Brachyelytrum.
In Town of Lake.

Phleum pratense L. Timothy.
Common everywhere.

Alopecurus geniculatus L. Marsh Fox-tail.
Common.

Sporobolus cryptandrus (Torr.) Gray. Sand Dropseed.
In Bay View.

Agrostis alba L. Red top. Herd-grass.
Within the city.

A. perennans (Walt.) Tuckerm. Thin-grass.
Wauwatosa.

A. hyemalis (Walt.) B. S. P. Rough Hair-grass.
Common in Town of Lake.

Calamagrostis canadensis (Michx.) Beauv. Blue Joint-grass.
Near New Coeln.

Ammophila arenaria (L.) Link. Sea Sand-reed.

Occasional.

Avena sativa L. Oat.

Occasionally escaped from cultivation.

Melica striata (Michx.) Hitch. *Avena striata* Michx. Purple Oat.
Town of Greenfield.

Danthonia spicata (L.) Beauv. Wild Oat-grass.

Common throughout county.

Spartina cynosuroides (L.) Roth. Tall Marsh-grass.

Milwaukee river, north of city limits.

Phragmites vulgaris (Lam.) B. S. P. *Phragmites Phragmites* (L.)

Karst. Reed. Southern part of county.

Eragrostis capillaris (L.) Nees. Capillary Eragrostis.

Near New Coeln.

E. minor Host. *E. Eragrostis* (L.) Karst. Low Eragrostis.

Bay View.

E. major Host. Strong-scented Eragrostis.

Reported by W. J. Bennetts from Menomonee Valley, near
Sixth St. viaduct.

E. hypnoides (Lam.) B. S. P. Creeping Eragrostis.

Near Forest Home Cemetery.

Dactylis glomerata L. Orchard grass.

Throughout county. Rare.

Poa annua L. Low Spear-grass.

Throughout county.

P. triflora Gilib. *P. flava* L. False Red-top.

Within city limits.

P. pratensis L. Kentucky Blue-grass. June-grass.

Common everywhere.

P. glauca Vahl. Glaucous Spear-grass.

Reported by Dr. L. Sherman.

P. debilis Torr. Weak Spear-grass.

Reported by Lapham.

P. compressa L. Wire grass.

Near New Coeln.

Glyceria nervata (Willd.) Trin. *Panicularia nervata* (Willd.) Kuntze.

Nerved Manna-grass. Southern part of county.

G. grandis Wats. *Panicularia Americana* (Torr.) Mac M.

Reed Meadow-grass.

Reported by A. Conrath as found in county.

G. septentrionalis Hitch. *Panicularia fluitans* (L.) Kuntze.

Floating Manna-grass.

Reported by A. Conrath as found in county.

Festuca ovina var. *duriuscula* (L.) Koch. Sheep's Fescue-grass.

Reported by A. Conrath as within city limits.

F. nutans Spreng. Nodding Fescue-grass.

Near New Coeln.

Bromus ciliatus L. Fringed Brome-grass.

Throughout county.

B. Kalmii Gray. Kalm's Chess.

Near New Coeln.

B. hordeaceus L. Soft Chess.

In Menomonee Valley.

B. secalinus L. Cheat. Chess.

Throughout county.

Lolium perenne L. Ray grass.

Town of Franklin.

Agropyron repens (L.) Beauv. Couch grass.

Menomonee Valley.

Hordeum jubatum L. Squirrel-tail grass.

Abundant in northern part of county.

Elymus virginicus L. Terrell-grass.

Town of Lake.

E. canadensis L. Nodding Wild-rye.

Near New Coeln.

E. arenarius L. Downy Lyme-grass.

Bay View.

Hystrix patula Moench. *Hystrix Hystrix* (L.) Mills.

Bottle-brush grass. Throughout county. Common.

CYPERACEÆ.

- Cyperus flavescens** L. Yellow Cyperus.
Town of Greenfield.
- C. diandrus** Torr. Low Cyperus.
Common in south and west part of county.
- C. esculentus** L. Yellow Nut-grass.
Milwaukee River, north of city limits.
- C. Engelmanni** Steud. Engelmann's Cyperus.
Milwaukee River, north of city limits.
- C. strigosus** L. Straw-colored Cyperus.
Near New Coeln.
- Dulichium arundinaceum** (L.) Britton. Dulichium.
Common throughout county.
- Eleocharis palustris** (L.) R. & S. Creeping Spike-rush.
Common throughout county.
- E. palustris** var. **glaucescens** (Willd.) Gray.
Milwaukee River, north of city limits.
- E. acicularis** (L.) R. & S. Needle Spike-rush.
National Ave., just west of city limits.
- E. tenuis** (Willd.) Schultes. Slender Spike-rush.
Town of Lake.
- E. acuminata** (Muhl.) Nees. Flat-stemmed Spike-rush.
Reported by Dr. L. Sherman.
- Scirpus americanus** Pers. Three-square. Chair-maker's rush.
Locally common.
- S. validus** Vahl. *S. lacustris* L. Great Bulrush.
Wauwatosa.
- S. atrovirens** Muhl. Dark-green Bulrush.
Common everywhere.
- S. cyperinus** (L.) Kunth. Wool-grass.
In southern part of county.
- S. Eriophorum** (L.) Michx. *S. cyprinus Eriophorum* (Michx.) Britton.
Dark-green Bulrush. Common everywhere.
- Eriophorum polystachyon** L. Tall Cotton-grass.
In southern and western parts of county.

- E. gracile** Roth. Slender Cotton grass.
Reported from Sec. 1, Town of Greenfield.
- Rhynchospora glomerata** (L.) Vahl. Clustered Beaked-rush.
South side of Menomonee Valley, near city limits.
- Cladium mariscoides** (Muhl.) Torr. Twig-rush.
Reported by Dr. L. Sherman.
- Carex intumescens** Rudge. Bladder Sedge.
Near New Coeln.
- C. lupulina** Muhl. Hop Sedge.
Common.
- C. lupuliformis** Sartwell. Hop-like Sedge.
Occasional.
- C. vesicaria** L. var. **monile** (Tuckerm.) Fernald. *C. monile* Tuckerm.
Necklace Sedge. Near New Coeln.
- C. lurida** Wahlenb. Sallow Sedge.
Occasional south.
- C. hystricina** Muhl. Porcupine Sedge.
Whitefish Bay and Menomonee Valley.
- C. trichocarpa** Muhl. Hairy-fruited Sedge.
Sec. 1. Town of Greenfield.
- C. Houghtonii** Torr. Houghton's Sedge.
Occasional.
- C. filiformis** L. Slender Sedge.
Southern part of the city.
- C. stricta** Lam. Tussock Sedge.
Locally common.
- C. gracillima** Schwein. Graceful Sedge.
Near New Coeln.
- C. granularis** Muhl. Meadow Sedge.
Near New Coeln.
- C. conoidea** Schk. Field Sedge.
Near Wauwatosa.
- C. laxiflora** Lam. Loose-flowered Sedge.
Lake Woods.

- C. aurea** Nutt. Golden-fruited Sedge.
Wauwatosa and along lake shore.
- C. pennsylvanica** Lam. Pennsylvania Sedge.
Common.
- C. novæ-angliæ** Schwein. New England Sedge.
National Ave., near city limits.
- C. præcox** Jacq. Vernal Sedge.
New Coeln, according to T. A. Bruhin.
- C. pubescens** Muhl. Pubescent Sedge.
New Coeln. Rare.
- C. scirpoidea** Michx. Scirpus-like Sedge.
Sec. 1, Town of Greenfield.
- C. leptalea** Wahlenb. Bristle-stemmed Sedge.
Sec. 1, Town of Greenfield.
- C. stipata** Muhl. Awl-fruited Sedge.
Within city limits.
- C. vulpinoidea** Michx. Fox Sedge.
Common, especially south.
- C. setacea** Dewey. Bristly-spiked Sedge.
Common.
- C. Sartwellii** Dewey. Sartwell's Sedge.
In a tamarack swamp Sec. 5, Town of Greenfield.
- C. tenella** Schk. Soft-leaved Sedge.
Occasional in southern part of county.
- C. rosea** Schk. Stellate Sedge.
National Ave., near city limits.
- C. sparganoides** Muhl. Bur-reed Sedge.
New Coeln.
- C. cephalophora** Muhl. Oval-headed Sage.
New Coeln.
- C. stellulata** Good. *C. sterilis* Willd. Little Prickly-sedge.
Sec. 1, Town of Greenfield.
- C. stellulata** Good. var. *cephalantha* Bailey. *C. sterilis cephalantha*
Bailey. Sec. 1, Town of Greenfield.

- C. interior** Bailey. Inland Sedge.
Fish Creek.
- C. tenuiflora** Wahlenb. Sparse-flowered sedge.
Same locality as above.
- C. trisperma** Dewey. Three-fruited Sedge.
Same locality as above.
- C. Deweyana** Schwein. Dewey's Sedge.
National Ave., near city limits.
- C. bromoides** Schk. Brome-like Sedge.
New Coeln.
- C. siccata** Dewey. Hillside Sedge.
Sec. 1, Town of Greenfield.
- C. scoparia** Schk. Pointed Broom Sedge.
Within city limits, according to A. Conrath.

ARACEÆ.

- Arisæma triphyllum** (L.) Schott. Indian Turnip.
Common.
- Calla palustris** L. Water Arum.
Reported by T. Bruhin from near New Coeln.
- Symplocarpa foetida** (L.) Nutt. *Spathyema foetida* (L.) Raf.
Skunk Cabbage. Common.
- Acorus Calamus** L. Sweet Flag.
Occasional throughout county.

LEMNACEÆ.

- Spirodela polyrhiza** (L.) Schleid. Greater Duckweed.
Common.
- Lemna trisulca** L. Ivy-leaved Duckweed.
Common.
- L. minor** L. Lesser Duckweed.
Common.

COMMELINACEÆ.

- Tradescantia virginiana** L. Spiderwort.
Occasional in south and west parts of county.

PONTEDERIACEÆ.

Heteranthera dubia (Jacq.) Mac M. Water Star-grass.

In Milwaukee River, near city limits.

JUNCACEÆ.

Juncus effusus L. Common Rush.

Locally common.

J. bufonius L. Toad Rush.

Locally common.

J. marginatus Rostk. Grass-leaved Rush.

Reported by Dr. L. Sherman.

J. alpinus Vill. var. **insignis** Fries. *J. Richardsonianus* Schult.

Richardson's Rush. Lake shore, south of city.

J. nodosus L. Knotted Rush.

Common.

Luzula pilosa Willd. *Juncoides pilosum* (L.) Kuntze.

Hairy Wood-rush.

Lake Woods, Whitefish Bay and Fish Creek. Occasional.

L. campestris (L.) DC. var. **multiflora** (Ehrh.) Celak. *Juncoides*

campestre (L.) Kuntze. Common Wood-rush. Occasional.

LILIACEÆ.

MELANTHACEÆ.

Tofieldia glutinosa (Michx.) Pers. Tofieldia.

Locally along bluffs of lake shore.

Uvularia perfoliata L. Perfoliate Bellwort.

Whitefish Bay.

U. grandiflora J. E. Smith. Large-flowered Bellwort.

Common.

LILIACEÆ.

Allium tricoccum Ait. Wild Leek.

Common.

A. cernuum Roth. Nodding Wild Onion.

Locally common.

A. canadense L. Meadow Garlic.

Common.

Lilium philadelphicum L. var **andinum** (Nutt) Ker. *L. umbellatum*

Pursh. Western Red Lily.

Bluffs of lake shore, north of Whitefish Bay.

Reported by Wheeler as *L. Philadelphicum* L.**L. canadense** L. Canada Lily.

Common.

L. superbum L. Turk's-cap Lily.

Reported by Bennetts. No specimen in Public Museum.

Not found since.

Erythronium americanum Ker. Yellow Adder's tongue.

Common.

E. albidum Nutt. White Adder's-tongue.

Common.

CONVALLARIACEAE.**Asparagus officinalis** L. Asparagus.

Common.

Clintonia borealis (Ait.) Raf. Yellow Clintonia.

Locally common.

Smilacina racemosa (L.) Desf. *Vagnera racemosa* (L.) Morong.

Wild Spikenard. Common.

S. stellata (L.) Desf. *V. stellata* (L.) Morong.

Star-flowered Solomon's Seal. Common.

S. trifolia (L.) Desf. *V. trifolia* (L.) Morong.

Three-leaved Solomon's Seal. Common.

Majanthemum canadense Desf. *Unifolium Canadense* (Desf.) Greene.

False Lily-of-the-Valley. Common.

Streptopus roseus Michx. Sessile-leaved Twisted-stalk.

Whitefish Bay and Wauwatosa. Not Common.

Polygonatum biflorum (Walt.) Ell. *Salomonias biflora* (Walt.) Britton.

Hairy Solomon's Seal. Common.

P. commutatum (R. & S.) Dietr. *Salomonias commutata* (R. & S.)

Britton. Smooth Solomon's Seal. Common.

Trillium recurvatum Beck. Prairie Trillium.

In western part of county.

T. nivale Riddell. Early Trillium.

Wauwatosa, Very local, rare.

T. grandiflorum (Michx.) Salisb. Large-flowered Trillium.

Abundant in most woods.

T. erectum L. Ill-scented Trillium.

Reported from several parts of county.

T. cernuum L. Nodding Trillium.

Fairly common.

SMILACEÆ.**Smilax herbacea** L. Carrion Flower.

Fairly common.

S. ecirrhata (Engelm.) S. Wats. Upright Smilax.

Common.

S. hispida Muhl. Hispid Greenbrier.

Fairly common.

AMARYLLIDACEÆ.**Hypoxis hirsuta** L. Coville. Star-grass.

Not common.

DIOSCOREACEÆ.**Dioscorea villosa** L. Wild Yam-root.

Not uncommon.

IRIDACEÆ.**Iris versicolor** L. Larger Blue Flag.

Common.

I. lacustris Nutt. Dwarf Lake Iris.

Wauwatosa. One station.

Sisyrinchium angustifolium Miller. Northern Blue-eyed Grass.

Locally common.

S. gramineum Curtis. *S. graminoides* Bicknell. Common Blue-eyed

Grass. Reported from Wauwatosa by John A. Brandon.

ORCHIDACEÆ.

Cypripedium acaule Ait. Stemless Ladies Slipper.

Reported by W. M. Wheeler. Not now found in county.

C. hirsutum Mill. *C. reginae* Walt. Showy Ladies Slipper.

In a few places. Becoming very rare.

C. parviflorum Salisb. Small Yellow Ladies Slipper.

Very rare.

C. parviflorum Salisb. var. **pubescens** (Willd.) Knight. *C. hirsutum* Mill. Large Yellow Ladies Slipper.

Throughout county. Not common.

Orchis spectabilis L. *Galeorchis spectabilis* (L.) Rybd.

Showy Orchis. Throughout county. Not common.

Habenaria bracteata (Willd.) R. Br. *Coeloglossum bracteatum* (Willd.) Parl. Low Bracted Orchis.

Throughout county. Not common.

H. hyperborea (L.) R. Br. *Limnorchis hyperborea* (L.) Rybd.

Tall Leafy Green Orchis.

Reported by Wheeler. Probably the following.

H. media Rybd. *Limnorchis media* Rybd. Intermediate Bog Orchis.

Throughout county. Common.

H. dilatata (Pursh.) Gray. *Limnorchis dilatata* (Pursh.) Rybd.

Tall White Bog Orchis.

Reported by Wheeler. Not reported recently.

H. Hookeri Torr. *Lysias Hookeriana* (Gray.) Rybd.

Hooker's Orchis. South and west parts of county. Rare.

H. lacera (Michx.) R. Br. *Blephariglottis lacera* (Michx.) Rybd.

Ragged Orchis. In Wheeler's list, as from Sec. 1, Greenfield.

H. psycodes (L.) Gray. *Blephariglottis psycodes* (L.) Rybd.

Smaller Purple-fringed Orchis.

Throughout county. Occasional.

Pogonia ophioglossoides (L.) Ker. Rose Pogonia.

Reported by T. A. Bruhin. Probably not now found in county.

Calopogon pulchellus (Sw.) R. Br. *Limodorum tuberosum* L.

Grass-pink. Calopogon. Reported by T. A. Bruhin. Probably not now found in county.

- Spiranthes Romanzoffiana** Cham. *Gyrostachys stricta* Rybd.
Hooded Ladies Tresses. One locality near Whitefish Bay.
- S. latifolia** Torr. *Gyrostachys plantaginea* (Raf.) Britton.
Wide-leaved Ladies Tresses. Along Milwaukee River. Rare.
- S. cernua** (L.) Richard. *Gyrostachys cernua* (L.) Kuntze.
Nodding Ladies Tresses.
Reported by Phillip Wells from Greenfield.
- Goodyera pubescens** (Willd.) R. Br. *Peramium pubescens*
(Willd.) Mac M. Downy Rattlesnake Plantain.
Sec. 32, Town of Oak Creek.
- Acroanthes monophylla** (L.) Greene. White Adders mouth.
Collected in county by Dr. H. E. Hasse.
- Aplectrum spicatum** (Walt.) B. S. P. Putty-root. Adam and Eve.
Two localities in Wauwatosa and Greenfield. Becoming rare.
- Corallorrhiza neottia** Scop. *C. Corallorrhiza* (L.) Karst.
Early Coral-root. Reported by Wheeler from Sec. 1, Greenfield. Not reported since.
- C. multiflora** Nutt. Large Coral-root.
Collected in county by Dr. H. E. Hasse.

SALICACE.

- Populus alba** L. White or Silver Poplar.
Escaping from cultivation. Planted along streets.
- P. candicans** Ait. Balm of Gilead.
Escaping from cultivation. Planted as a shade tree.
- P. balsamifera** L. Balsam Poplar.
In Wheeler's list. Not reported since.
- P. nigra** L. var. *italica* Du Roi. Lombardy Poplar.
Escaping from cultivation. Formerly planted extensively.
- P. deltoides** Marsh. Cottonwood. Occasional throughout county.
Common in Menomonee Valley.
- P. grandidentata** Michx. Large-toothed Aspen.
Common throughout county.
- P. tremuloides** Michx. American Aspen.
Common throughout county.

- Salix nigra** Marsh. Black Willow.
Throughout county. Not common.
- S. nigra** var. **falcata** (Pursh.) Torr.
Probably conspecific with *S. nigra*.
- S. amygdaloides** Anders. Peach-leaved Willow.
Abundant throughout county.
- S. lucida** Muhl. Shining Willow.
Common.
- S. serissima** (Bailey.) Fernald.
Whitefish Bay. Near New Coeln.
- S. fragilis** L. Crack Willow. Sparingly planted.
Occasionally escaped from cultivation.
- S. alba** L. White Willow.
Cultivated in city parks under name of *S. regalis*.
- S. alba** var. **vitellina** (L.) Koch. *S. vitellina* L. White Willow.
A shade tree throughout city.
- S. pentandra** L. *S. laurifolia* Hort.
Cultivated in city parks.
- S. babylonica** L. Weeping Willow.
Cultivated. Occasionally escaped.
- S. babylonica** var. **dolorosa**. Wisconsin Weeping Willow.
Cultivated in city parks.
- S. glaucophylla** Bebb. Broad-leaved Willow.
Common in neighborhood of lake shore.
- S. cordata** Muhl. Heart-leaved Willow.
Common throughout county.
- S. pedicellaria** Pursh. *S. myrtilloides* L. Bog Willow.
In Wheeler's list. Not reported since.
- S. longifolia** Muhl. *S. fluvialis* Nutt. Sand-bar Willow.
Common.
- S. petiolaris** J. E. Smith. Slender Willow.
Throughout county. Fairly common.
- S. discolor** Muhl. Glaucous Willow.
Very common.
- S. rostrata** Richards. *S. Bebbiana* Sarg. Bebb's Willow.
Common.

- S. tristis** Ait. Dwarf Gray Willow.
Reported by J. A. Brandon in 1900. Not reported since.
- S. candida** Fluegge. Hoary Willow.
Reported from Greenfield and Oak Creek. Very rare, if not now extinct in county.
- S. viminalis** L. Osier Willow.
In Wheeler's list. Probably confused with the following species.
- S. purpurea** L. Purple Willow.
Escaped from cultivation. Locally common throughout county.

JUGLANDACEÆ.

- Juglans nigra** L. Black Walnut.
Formerly abundant. Not common now.
- J. cinerea** L. Butternut.
Throughout county. Occasional.
- Carya cordiformis** (Wang.) K. Koch. *Hicoria minima* (Marsh.) Britton. Bitter-nut. Throughout county. Not common.
- C. ovata** (Mill.) K. Koch. *Hicoria ovata* (Mill.) Britton. Shag-bark Hicory. Throughout county. Fairly common. Given in Wheeler's list as *C. alba* Nutt.
- C. glabra** (Mill.) Spach. *Hicoria glabra* (Mill.) Britton. Pignut.
Reported from Wauwatosa. Probably planted.

BETULACEÆ.

- Carpinus caroliniana** Walt. Blue Beech. Hornbeam.
Throughout county. Occasional.
- Ostrya virginiana** (Mill.) K. Koch. Iron-wood. Hop-hornbeam.
Throughout county. Common.
- Corylus americana** Walt. Hazel-nut.
Common.
- C. rostrata** Ait. Beaked Hazel-nut.
Not so common as *C. americana*.

- Betula alba** var. **papyrifera** (Marsh.) Spach. *B. papyrifera* Marsh.
Paper Birch. Common near lake shore.
- B. lenta** L. Black Birch.
In northern part of county, also reported from Greenfield.
- B. lutea** Michx. f. Yellow Birch.
Throughout county. Occasional.
- B. glandulosa** Michx. Scrub Birch.
"Lincoln Ave. Swamps," Menomonee Valley in Wauwatosa
and Kinnickinnic River, near Forest Home Cemetery.
- B. pumila** L. Low Birch.
Reported by W. M. Wheeler from Sec. 1, Greenfield.
- Alnus mollis** Fernald. *A. Alnobetula* (Ehrh.) K. Koch.
Green Alder. Near Oak Creek Station.
- A. rugosa** (Du Roi) Spreng. Smooth Alder.
Common throughout county.

FAGACEÆ.

- Fagus grandifolia** Ehrh. *F. Americana* Sweet. Beech.
Throughout county. Common.
- Quercus rubra** L. Red Oak.
Common throughout county.
- Q. coccinea** Muench. Scarlet Oak.
Throughout the county.
- Q. ellipsoidalis** E. J. Hill. Hill's Oak.
Throughout county. Given as *Q. palustris* in Wheeler's list.
- Q. velutina** Lam. Black Oak.
Throughout county.
- Q. alba** L. White Oak.
Common.
- Q. stellata** Wang. *Q. minor* (Marsh.) Sarg. Post Oak.
Reported by Wheeler. Probably *Q. alba* L.
- Q. macrocarpa** Michx. Bur Oak.
Common throughout county.
- Q. bicolor** Willd. *Q. platanooides* (Lam.) Sudw. Swamp White Oak.
Common throughout county.

URTICACEÆ.

ULMACEÆ.

Ulmus americana L. White Elm.

Common.

U. racemosa Thomas. Cork or Rock Elm.

In western part of county and occasional in eastern portion.

U. fulva Michx. Red or Slippery Elm.

Throughout county.

Celtis occidentalis L. Sugar-berry. Nettle-tree.

Along Milwaukee River in extreme northern part of county;
also in Menomonee Valley.

MORACEÆ.

Humulus Lupulus L. Hop.

Occasionally escaped from cultivation.

Cannabis sativa L. Hemp.

Occasionally escaped from cultivation.

URTICACEÆ.

Urtica dioica L. Great Nettle.

Common.

U. gracilis Ait. Slender Nettle.

Common.

Laportea canadensis (L.) Gaud. *Urticastrum divaricatum* (L.) Kuntze.

Wood Nettle. Common south and west.

Pilea pumila (L.) Gray. *Adicea pumila* (L.) Raf.

Clear-weed. Richweed. Throughout county. Common.

Boehmeria cylindrica (L.) Sw. False Nettle.

Common.

Parietaria pennsylvanica Muhl. Pellitory.

A weed in gardens.

SANTALACEÆ.

Commandra umbellata (L.) Nutt. Bastard Toad Flax.

In southern part of county, in Menomonee Valley and at
Whitefish Bay. Not common.

ARISTOLOCHIACEÆ.

Asarum canadense L. Wild Ginger.

In Menomonee Valley and along Milwaukee River. Not common.

A. canadense var. **acuminatum** Ashe. *A. acuminatum* (Ashe.) Bicknell.
Long-tipped Wild Ginger. Reported by P. H. Dernehl from
Sec. 29, Town of Milwaukee.

POLYGONACEÆ.

Rumex Acetosella L. Sheep Sorrel.
Common.

R. verticillatus L. Swamp Dock.
In Menomonee Valley and near New Coeln. Not common.

R. Patientia L. Patience Dock.
In yards in city. Not common.

R. crispus L. Curled Dock.
Common.

R. conglomeratus Murr. Clustered Dock.
Wauwatosa.

R. obtusifolius L. Bitter Dock.
Wauwatosa.

Fagopyrum esculentum Moench. *F. Fagopyrum* (L.) Karst.
Buckwheat. Occasionally escaped from cultivation.

Polygonum amphibium L. Water Persicaria.
Throughout county. Not common.

P. amphibium var. **Hartwrightii** (Gray.) Bissel. *P. Hartwrightii* Gray.
Hart Wrights' Persicaria. One locality in Wauwatosa.

P. Muhlenbergii (Meisn.) Wats. *P. emersum* (Michx.) Britton.
Swamp Persicaria. In Menomonee Valley.

P. lapathifolium L. *P. incarnatum* Ell. Slender Persicaria.
Town of Lake and Jones Island. Abundant.

P. pennsylvanicum L. Pennsylvania Persicaria.
Throughout county. Locally abundant.

P. Persicaria L. Lady's Thumb.
Common.

P. Careyi Olney. Carey's Persicaria.
Town of Lake.

- P. hydropiperoides** Michx. Mild Water Pepper.
Throughout county. Occasional.
- P. Hydropiper** L. Water Pepper. Smartweed.
Throughout county. Occasional.
- P. acre** HBK. *P. punctatum* Ell. Dotted Smartweed.
In Menomonee Valley, Wauwatosa.
- P. orientale** L. Prince's Feather.
Waste places throughout city.
- P. virginianum** L. Virginia Knotweed.
Spring Meadow and Williamsburg.
- P. aviculare** L. Doorweed.
Common everywhere.
- P. maritimum** L. Seaside Knotweed.
A single specimen reported from Bay View by T. Kumlien.
- P. erectum** L. Erect Knotweed.
Locally abundant.
- P. Convolvulus** L. Black Bindweed.
Common everywhere.
- P. ciliinode** Michx. Fringed Black Bindweed.
On lake shore at Oak Creek. Cudahy.
- P. dumetorum** L. Hedge Buckwheat.
Near New Coeln.
- P. sagittatum** L. Arrow-leaved Tear-thumb.
Southern part of county.

CHENOPODIACEÆ.

- Chenopodium album** L. Lamb's Quarters.
Common everywhere.
- C. glaucum** L. Oak-leaved Goosefoot.
Gardens in city.
- C. Boscianum** Moq. Bosc's Goosefoot.
Occasional in western part of city.
- C. hybridum** L. Maple-leaved Goosefoot.
Gardens and waste places. Common.

C. Botrys L. Jerusalem Oak.

Forest Home Cemetery and along streets of city.

C. capitatum (L.) Asch. *Blitum capitatum* L. Strawberry Blite.

Throughout county. Not common.

Atriplex patula L. Spreading Orache.

Gardens and waste places throughout city.

A. patula var. hastata (L.) Gray. *A. hastata* L. Halberd-leaved

Orache. Throughout city. Common.

Salsola Kali L. Saltwort.

Reported by Lapham along lake shore in 1852.

S. Tragus L. Russian Thistle.

Common nearly everywhere, in neighborhood of R. R. tracks.

AMARANTHACEÆ.

Amaranthus retroflexus L. Rough Pigweed.

Common.

A. hybridus L. Slender Pigweed.

Menomonee Valley. Sparse.

A. paniculatus L. Paniculate Pigweed.

Menomonee Valley. Sparse.

A. blitoides S. Wats. Prostrate Amaranth.

Common.

A. græcizans L. Tumble-weed.

Common.

Acnida tamariscina (Nutt.) Wood. Western Water-hemp.

Occurs within the city limits according to Conrath.

A. tuberculata Moq. *A. tamariscina tuberculata* (Moq.) U. & B.

Menomonee Valley. One locality.

NYCTAGINACEÆ.

Oxybaphus nyctagineus (Michx.) Sweet. *Allionia nyctaginea* Michx.

Heart-leaved Umbrella-wort.

In several localities. Spreading rapidly.

O. hirsutus (Michx.) Sweet. *Allionia hirsuta* Pursh. Hairy Umbrella-

wort. Along railway tracks. Local.

AIZOACEÆ.

Mullugo verticillata L. Carpet-weed.

In Menomonee Valley. Two localities.

PORTULACACEÆ.

Claytonia virginica L. Spring Beauty.

Common.

Portulaca oleracea L. Purslane. Pursley.

A weed in gardens.

CARYOPHYLLACEÆ.

Agrostemma Githago L. Corn Cockle.

In southern part of county. Not common.

Silene stellata (L.) Ait. Starry Campion.

Common.

S. vulgaris (Moench.) Garcke. Bladder Campion.

In southern part of county. Uncommon.

S. antirrhina L. Sleepy Gatchfly.

A single specimen in Public Museum from Schweichert's woods. Menomonee Valley.

S. Armeria L. Sweet William Catchfly.

Escaped from gardens. Rare.

S. noctiflora L. Night-flowering Catchfly.

Common.

Lychnis alba Mill. White Campion.

Becoming common.

L. calcedonica L. Scarlet Lychnis.

Escaped from gardens. St. Francis.

Saponaria officinalis L. Soapwort. Bouncing Bet.

Throughout county. Locally abundant.

S. Vaccaria L. *Vaccaria Vaccaria* (L.) Britton. Cowherb.

Occasional along railroads. Common south among grain.

Stellaria media (L.) Cyrill. *Alsine media* L. Common Chickweed.

Abundant.

- S. longifolia** Muhl. *Alstne longifolia* (Muhl.) Britton. Long-leaved
Stitchwort.
Menomonee Valley and Sec. 29, Town of Milwaukee.
- S. longipes** Goldie. *Alstne longipes* (Goldie.) Coville. Long-stalked
Stitchwort. Menomonee Valley and Wauwatosa.
- Cerastium viscosum** L. Mouse-ear Chickweed.
Common.
- C. vulgatum** L. Larger Mouse-ear Chickweed.
Common.
- Arenaria lateriflora** L. *Moehringia lateriflora* (L.) Fenzl. Blunt-leaved
Sandwort. Throughout county.

NYMPHÆACEÆ.

- Nuphar advena** Ait f. *Nymphaea advena* Soland. Large Yellow Pond
Lily. Milwaukee River. Rare. Formerly in Menomonee and
Kinnickinnic Rivers.
- Nymphaea odorata** Ait. *Castalia odorata* (Dryand.) Woodv. & Wood.
White Pond Lily. Milwaukee River. Rare. Formerly in
Menomonee and Kinnickinnic Rivers.

CERATOPHYLLACEÆ.

- Ceratophyllum demersum** L. Horn-wort.
In Menomonee Valley at foot of 18th Str.

MAGNOLIACEÆ.

- Liriodendron tulipifera** L. Tulip Tree.
A few in city parks.

RANUNCULACEÆ.

- Hydrastis canadensis** L. Golden Seal.
Wauwatosa and Oak Creek. Locally abundant.
- Caltha palustris** L. Marsh Marigold.
Common.
- Coptis trifolia** (L.) Salish. Gold-thread.
Near Whitefish Bay.

Isopyrum biternatum (Raf.) T. & G. False Rue Anemone.

Wauwatosa. Not common.

Actæa rubra (Ait.) Willd. Red Baneberry.

Throughout county. Not common.

A. alba (L.) Mill. White Baneberry.

Throughout county. Occasional.

Aquilegia canadensis L. Wild Columbine.

Throughout county. Not common.

A. vulgaris L. European Columbine.

Reported by P. Dernehl from Milwaukee River.

Delphinium Consolida L. Field Larkspur.

Occasionally escaped from gardens.

D. azureum Michx. *D. Carolinianum* Walt. Carolina Larkspur.

Bennetts reports it from waste places in city.

Anemone cylindrica Gray. Long-fruited Anemone.

Throughout county.

A. virginiana L. Tall Anemone.

Throughout county.

A. canadensis L. Canada Anemone.

Throughout county. Occasional.

A. quinquefolia L. Wind-flower.

Throughout county. Locally abundant.

A. patens L. var. *Wolfgangiana* (Bess.) Koch. *Pulsatilla hirsutissima*

(Pursh.) Britton. Nuttalls' Pasque Flower.

In Wheeler's list on authority of Mr. Wernich.

Hepatica triloba Chaix. *H. Hepatica* (L.) Karst. Round-leaved

Hepatica. Common.

H. acutiloba DC. *H. acuta* (Pursh.) Britton. Sharp-lobed Hepatica.

Very common.

Anemonella thalictroides (L.) Spach. *Syndesmon thalictroides* (L.)

Hoffmg. Rue Anemone. Common.

Clematis virginiana L. Virgin's Bower.

Throughout county. Occasional.

Ranunculus delphinifolius Torr. Yellow Water Crowfoot.
Common.

R. laxicaulis (T. & G.) Darbey. *R. obtusiusculus* Raf. Water-plantain Spearwort.

Reported by T. Bruhin from southern part of county.

R. rhomboideus Goldie. *R. ovalis* Raf. Prairie Crowfoot.
Wauwatosa.

R. abortivus L. Kidney-leaved Crowfoot.
Common.

R. micranthus Nutt. Rock Crowfoot.
Occasional.

R. sceleratus L. Celery-leaved Crowfoot.
Occasional in south and west parts of county.

R. recurvatus Poir. Hooked Crowfoot.
Throughout county.

R. acris L. Tall Buttercup.
Throughout county.

R. bulbosus L. Bulbous Buttercup.
Wauwatosa.

R. pennsylvanicus L. f. Bristly Buttercup.
Southern part of county.

R. repens L. Creeping Buttersup.
Common.

R. septentrionalis Poir. Marsh Buttercup.
Wauwatosa.

R. fascicularis Muhl. Tufted Buttercup.
Throughout county.

R. aquatilis var. *capillaceus* DC. *Batrachium trichophyllum* (Chaix.)
Bossch. White Water Crowfoot. South and west.

Thalictrum dioicum L. Early Meadow-Rue.
Common.

T. revolutum DC. *T. purpurascens* L. Purplish Meadow Rue.
Common.

T. polygamum Muhl. Tall Meadow-Rue.
Throughout county.

BERBERIDACEÆ.

Barberis vulgaris L. European Barberry.

Occasionally escaped from cultivation.

Caulophyllum thalictroides (L.) Michx. Blue Cohosh.

West and south. Not common.

• **Jeffersonia diphylla** (L.) Pers. Twin-leaf.

Wauwatosa. One locality. Abundant.

Podophyllum peltatum L. May Apple. Mandrake.

Abundant.

MENISPERMACEÆ.

Menispermum canadense L. Canada Moonseed.

Throughout county. Not common.

PAPAVERACEÆ.

Papaver somniferum L. Garden Poppy.

Occasionally escaped from cultivation.

P. Rhœas L. Field Poppy.

Rarely escaped from cultivation.

Argemone mexicana L. Prickly Poppy.

A single specimen in Public Museum herbarium. Reported from south side of city.

Sanguinaria canadensis L. Bloodroot.

Common.

Dicentra Cucullaria (L. Bernh. *Bicuculla Cucullaria* (L.) Millsp.

Dutchman's Breeches. Throughout county. Local.

D. canadensis (Goldie.) Walp. *Bicuculla Canadensis* (Goldie.) Millsp.

Squirrel Corn. Menomonee Valley.

Corydalis aurea Willd. *Capnoides aureum* (Willd.) Kuntze.

Golden Corydalis. Reported by Wheeler from lake beach in northeast part of county.

Fumaria officinalis L. Fumitory.

Near Forest Home Cemetery.

CRUCIFERÆ.

- Lepidium ruderales** L. Roadside Pepper-grass.
Waste-places in the city.
- L. virginicum** L. Wild Pepper-grass.
A weed along roads.
- L. apetalum** Willd. Apetalous Pepper-grass.
Waste-places and roadsides. Greenfield. Locally abundant.
- Thlaspi arvense** L. Penny-cress.
Menomonee Valley.
- Sisymbrium officinale** (L.) Scop. var. **lelocarpum** DC. *Sisymbrium officinale* (L.) Scop. Hedge Mustard. Common.
- S. altissimum** L. Tall Sisymbrium.
Common.
- Cakile edentula** (Bigel.) Hook. Sea Rocket.
Common in sand along lake shore.
- Brassica nigra** (L.) Koch. Black Mustard.
Common.
- B. juncea** (L.) Cosson. Indian Mustard.
Common.
- B. arvensis** (L.) Kuntze. Charlock.
Common.
- B. campestris** L. Turnip.
Occasionally escaped from cultivation.
- Diplotaxis bracteata** Gren. & Godr.
Menomonee Valley. One locality.
- Raphanus sativus** (L.) Garden Radish.
Occasionally escaped from cultivation.
- Roripa palustris** (L.) Bess. Yellow Water-cress.
Not common.
- R. Nasturtium** (L.) Rusby. Water-cress.
Common.
- R. Armoracia** (L.) A. S. Hitchcock. Horse-radish.
Occasionally escaped from cultivation.
- Cardamine pratensis** L. Meadow Bitter-cress.
Menomonee Valley and Johnson's Woods.

- C. hirsuta** L. Hairy Bitter-cress.
Wauwatosa. Sec. 6, Greenfield.
- C. pennsylvanica** Muhl. Pennsylvania Bitter-cress.
South and west. Occasional.
- C. parviflora** L. *C. arenicola* Britton. Sand Bitter-cress.
Menomonee Valley.
- C. purpurea** (Torr.) Britton. Purple Cress.
Common.
- C. bulbosa** (Schreb.) B. S. P. Bulbous Cress.
Throughout county. Occasional.
- Dentaria laciniata** Muhl. Cut-leaved Pepper-root.
Wauwatosa and Oak Creek.
- D. maxima** Nutt. Large Toothwort.
Wauwatosa and Greenfield.
- Capsella Bursa-pastoris** Moench. *Bursa Bursa-pastoris* (L.) Britton.
Shepherd's Purse. Everywhere.
- Camelina sativa** (L.) Crantz. False Flax.
Reported by Wheeler from south and west.
- Arabis laevigata** (Muhl.) DC. Smooth Rock-cress.
Southern part of county and in Wauwatosa.
- A. canadensis** L. Sickie-pod.
Throughout county.
- A. brachycarpa** (T. & G.) Britton. Purple Rock-cress.
Menomonee Valley.
- A. glabra** (L.) Bernh. Tower Mustard.
North of Whitefish Bay.
- Erysimum cheiranthoides** L. Worm-seed.
Not common.
- Berteroa incana** (L.) DC. Hoary Alyssum.
Wauwatosa.
- Hesperis matronalis** L. Dame's Rocket.
Occasionally escaped from cultivation.
- Conringia orientalis** (L.) Dumort. Hare's-ear.
Along lake shore. Rare.

CAPPARIDACEÆ.

Cleome spinosa L. Spider-flower.

Reported by Dr. L. Sherman.

Polanisia graveolens Raf. Clammy-weed.

Reported from Menomonee Valley by F. Runge. Specimen
in Public Museum herbarium.

SARRACENIACEÆ.

Sarracenia purpurea L. Pitcher-plant.

Once abundant. Now probably extinct.

DROSERACEÆ.

Drosera rotundifolia L. Round-leaved Sundew.

Reported by T. A. Bruhin. Probably now extinct.

CRASSULACEÆ.

Sedum Telephium L. Live Forever.

Occasionally escaped from cultivation.

PENTHORACEÆ.

Penthorum sedoides L. Ditch Stone-crop.

Common.

PARNASSIACEÆ.

Parnassia caroliniana Michx. Grass of Parnassus.

Throughout county. Locally abundant.

SAXIFRAGACEÆ.

Saxifraga pennsylvanica L. Swamp Saxifrage.

Common.

Heuchera hispida Pursh. Rough Heuchera.

Occasional throughout county.

Mitella diphylla L. Two-leaved Mitrewort.

Common.

M. nuda L. Naked Mitrewort.

North of Whitefish Bay and near New Coeln.

GROSSULARIACEÆ.

- Ribes Cynosbati** L. Wild Gooseberry.
Common.
- R. oxyacanthoides** L. Hawthorn Gooseberry.
In southern parts of county and in Wauwatosa.
- R. rotundifolium** Michx. Eastern Gooseberry.
Common.
- R. gracile** Michx. Slender Gooseberry.
Common.
- R. prostratum** L'Her. Fetid Currant.
Wauwatosa.
- R. rubrum** L. Red Currant.
Throughout county. Not common.
- R. floridum** L'Her. Wild Black Currant.
Not uncommon.

HAMAMELIDACEÆ.

- Hamamelis virginiana** L. Witch Hazel.
Common.

PLATANACEÆ.

- Platanus occidentalis** L. Sycamore. Button-wood.
Planted in city parks.

ROSACEÆ.

- Physocarpus opulifolius** (L.) Maxim. *Opulaster opulifolius* (L.) Kuntze.
Ninebark.
Wauwatosa and Milwaukee River.
- Spiræa salicifolia** L. Willow-leaved Meadow-sweet.
Throughout county. Common.
- Rubus triflorus** Richardson. *R. Americanus* (Pers.) Britton. Dwarf
Raspberry. Throughout county. Not common.
- R. strigosus** Michx. Wild Red Raspberry.
Throughout county. Common.
- R. occidentalis** L. Blackcap. Thimble-berry.
Throughout county. Not common.

- R. nigrobaccus** Bailey. High-bush Blackberry.
Occasional. A division of *R. villosus* Ait.
- R. canadensis** L. Dewberry.
Throughout county.
- R. Baileyanus** Britton. Bailey's Blackberry.
Milwaukee River.
- R. hispidus** L. Running Swamp Blackberry.
Occasional throughout county.
- Fragaria virginiana** Duchesne. Scarlet Strawberry.
Throughout county. Common.
- F. vesca** L. Wood Strawberry.
Throughout county. Common.
- Potentilla arguta** Pursh. *Drymocallis arguta* (Pursh.) Rybd.
Tall Cinquefoil. Northeast portion of county.
- P. fruticosa** L. *Dasiphora fruticosa* (L.) Rybd. Shrubby Cinquefoil.
Wauwatosa, also reported by F. Runge from Menomonee Valley.
- P. palustris** L. Scop. *Comarum palustre* L. Purple Cinquefoil.
In south and west parts of county.
- P. Anserina** L. *Argentina Anserina* (L.) Rybd. Silver-weed.
Along railroad tracks and on lake shore.
- P. argentea** L. Silvery Cinquefoil.
Near Hales Corners.
- P. monspellensis** L. Rough Cinquefoil.
Throughout county. Common.
- P. canadensis** L. Five-finger.
Throughout county.
- Geum canadense** Jacq. White Avens.
Common.
- G. virginianum** L. Rough Avens.
Southern part of county and Whitefish Bay.
- G. macrophyllum** Willd. Large-leaved Avens.
Whitefish Bay.
- G. strictum** Ait. Yellow Avens.
Throughout county. Common.

G. rivale L. Purple Avens.

Throughout county. Not uncommon.

Agrimonia gryposepala Wallr. *A. hirsuta* (Muhl.) Bicknell. Tall Agrimony. Very common.

Rosa blanda Ait. Smooth Rose.

Common.

R. acicularis Lindl. *R. Sayi* Schwein. Prickly Rose.

Common.

R. carolina L. Swamp Rose.

Common.

R. virginiana Mill. *R. lucida* Ehrh. Glossy Rose.

Reported by Wheeler. Not reported since.

R. humilis Marsh. Pasture Rose.

Common.

R. rubiginosa L. Sweetbrier.

Reported by Bennetts from Oak Creek and Wauwatosa.

POMACEAE.

Pyrus americanus (Marsh.) DC. *Sorbus Americanus* Marsh.

Mountain Ash. Known here only in cultivation.

P. coronaria L. *Malus coronaria* (L.) Mill. Crab Apple.

Common.

P. arbutifolia (L.) L. f. *Aronia arbutifolia* (L.) Medic. Chokeberry.

Reported from two localities, south and west.

Amelanchier canadensis (L.) Medic. Service-berry.

Throughout county.

A. canadensis (L.) Medic. var. **Botryapium** (L. f.) T. & G. *A. Botryapium* (L. f.) DC. Shad-bush.

Throughout county. Locally abundant.

A. spicata (Lam.) C. Koch. *A. rotundifolia* (Michx.) Roem. Round-leaved June-berry. Northeast portion of county. "A. spicata (Lam.) Dec. Low June-berry." Reported by Bennetts from top of bluff just northwest of Wells Str. viaduct.

Crataegus punctata Jacq. Large-fruited Thorn.

Throughout county. Very common.

C. sertata Sarg. *C. flabellata* (Spach.) Rybd. Fan-leaved Thorn. Fox Point.

- C. cordata** (Mill.) Ait. Washington Thorn.
Reported by F. Runge from Greenfield.
- C. conjuncta** Sarg. *C. pruinosa* (Wendl.) Beadle. Pruinose Thorn.
Johnson's Woods. Abundant.
- C. coccinea** L. Scarlet Thorn.
Johnson's Woods.
- C. subrotundifolia** Sarg. *C. coccinea* L. Scarlet Thorn.
Honey Creek in Wauwatosa.
- C. tarda** Sarg. *C. tenuifolia* Britton. Thin-leaved Thorn.
Fox Point. Abundant.
- C. cyanophylla** Sarg. *C. tenuifolia* Britton.
Throughout county. Abundant.
- C. lucorum** Sarg. *C. tenuifolia* Britton.
Honey Creek in Wauwatosa.
- C. macracantha** Lodd. Long-spined Thorn.
In southern part of county. Occasional.
- C. sera** Sarg. *C. mollis* (T. & G.) Scheele. Red-fruited Thorn.
Throughout county. Common.
- C. tomentosa** L. Pear Thorn.
Throughout county. Common.
- C. rutila** Sarg. *C. tomentosa* L.
Along Milwaukee River. Occasional.

DRUPACEÆ.

- Prunus americana** Marsh. Wild plum.
Throughout county. Common.
- P. spinosa** L. Blackthorn.
One specimen reported by T. Bruhin.
- P. pennsylvanica** L. f. Wild Red Cherry.
Not common.
- P. virginiana** L. Choke Cherry.
Throughout county. Common.
- P. serotina** Ehrh. Wild Black Cherry.
Very common.

LEGUMINOSÆ.

CAESALPINIACEÆ.

Cassia Chamæcrista L. Partridge Pea.

Reported from one location in city.

Gleditsia triacanthos L. Honey Locust.

Along several roads leading to city. Probably planted.

PAPILIONACEÆ.

Baptisia leucantha T. & G. White Indigo.

A few specimens reported from Bay View.

Genista tinctoria L. Dyeweed.

Reported from lake shore, Seventh Ward.

Medicago sativa L. Alfalfa.

Becoming common.

M. lupulina L. Black Medic.

Very common.

Mellilotus alba Desr. White Sweet-clover.

Very common.

M. officinalis (L.) Lam. Yellow Sweet-clover.

Not uncommon.

Trifolium agrarium L. *T. aureum* Poll. Hop Clover.

Menomonee Valley and Oak Creek. Occasional.

T. procumbens L. Low Hop-clover.

Throughout county.

T. dubium Sibth. Least Hop-clover.

North Greenfield. Occasional.

T. incarnatum L. Italian Clover.

One locality in Wauwatosa. Escaped from cultivation.

T. arvense L. Rabbit-foot Clover.

Menomonee Valley and Whitefish Bay. Not common.

T. pratense L. Red Clover.

Everywhere.

T. hybridum L. Alsatian Clover.

Common.

T. repens L. White Clover.

Everywhere.

Psoralea Onobrychis Nutt. Sainfoin *Psoralea*.

Reported by E. Brunken from lake bluffs near county line.

Amorpha canescens Pursh. Lead-plant.

Wauwatosa. Probably elsewhere.

Robinia Pseudacacia L. Locust.

Common along roads. Planted.

Astragalus canadensis L. *A. Carolinianus* L. Milk Vetch.

Throughout county.

A. neglectus (T. & G.) Sheldon. *Phaca neglecta* T. & G.

Coopers Milk Vetch. Throughout county.

Desmodium grandiflorum (Walt.) DC. *Meibomia grandiflora* (Walt.)

Kuntze. Large flowered Tick-trefoil. Everywhere.

D. pauciflorum (Nutt.) DC. *Meibomia pauciflora* (Nutt.) Kuntze.

Few-flowered Tick-trefoil. Lake Woods. Rare.

D. paniculatum (L.) DC. *Meibomia paniculata* (L.) Kuntze.

Panicled Tick-trefoil. Wauwatosa and Whitefish Bay.

D. canadense (L.) DC. *Meibomia Canadensis* (L.) Kuntze.

Showy Tick-trefoil. Common.

Lespedeza repens (L.) Bart. Creeping Bush-clover.

Wauwatosa.

L. capitata Michx. Round-headed Bush-clover.

Bay View.

Vicia Cracca L. Tufted Vetch.

Whitefish Bay, Town of Oak Creek, Town of Greenfield. Rare.

V. americana Muhl. American Vetch.

Throughout county. Common.

V. caroliniana Walt. Carolina Vetch.

Throughout county. Common.

V. sativa L. Common Vetch. Tare.

Whitefish Bay. Common.

V. sativa L. var. *nigra* L. *V. angustifolia* Roth. Smaller Common

Vetch. Whitefish Bay and vacant lots in city.

Lathyrus maritimus (L.) Bigel. Beach Pea.

Along lake beach. Abundant.

L. venosus Muhl. Veiny Pea.

Throughout county. Common.

L. palustris L. Marsh Vetchling.

Throughout county. Not uncommon.

L. ochroleucus Hook. Cream-colored Vetchling.

Very common.

Amphicarpa comosa (L.) G. Don. *Falcata comosa* (L.) Kuntze.

Hog Peanut. Throughout county. Common.

A. Pitcheri T. & G. *Falcata Pitcheri* (T. & G.) Kuntze. Pitcher's

Hog Peanut. Lake Woods and Whitefish Bay. Abundant.

Apios tuberosa Moench. *Apios Apios* (L.) Mac M. Ground-nut.

Wauwatosa and Milwaukee River. Not common.

GERANIACEÆ.

Geranium maculatum L. Wild Crane's-bill.

Everywhere.

G. carolinianum L. Carolina Crane's-bill.

National Ave., east of Soldiers' Home.

OXALIDACEÆ.

Oxalis repens Thumb. *O. corniculata* L. Procumbent Wood-sorrel.

A weed in city gardens.

O. stricta L. Upright Wood-sorrel.

Common.

LINACEÆ.

Linum usitatissimum L. Flax.

Throughout county. Occasional along R. R. tracks.

L. Lewisii Pursh. Lewis' Wild Flax.

Reported by Bennetts from a vacant lot on east side of city.

RUTACEÆ.

Xanthoxylum americanum Mill. Prickly Ash.

Common in open woods, south and west.

Ptelea trifoliata L. Three-leaved Hop-tree.

Common in Menomonee Valley.

SIMARUBACEÆ.

Ailanthus glandulosa Desf. *Ailanthus*.

Cultivated as a shade tree.

POLYGALACEÆ.

Polygala Senega L. Snakeroot.

Wauwatosa and Whitefish Bay. Locally abundant.

P. Senega var. *latifolia* T. & G.

In woods near waterworks at Wauwatosa.

EUPHORBIACEÆ.

Croton texensis (Klotzsch.) Muell. Arg. Texas Croton.

Near Kinnickinnic River. Reported from one locality.

Acalypha virginica L. Three-seeded Mercury.

Reynolds' Woods. Copious.

Ricinus communis L. Castor-bean.

Occasionally escaped from cultivation.

Euphorbia polygonifolia L. Knotted Spurge.

In sand of lake beach. Locally abundant.

E. glyptosperma Englm. Ridge-seeded Spurge.

In sand of beach and along R. R. tracks. Locally abundant.

E. glyptosperma var. *pubescens* Engelm.

Along railroad tracks. Locally abundant.

E. maculata L. Spotted Spurge.

Common in sand.

E. Preslii Guss. *E. nutans* Lag. Large Spotted Spurge.

Western and southern parts of county. Locally abundant.

E. corollata L. Flowering Spurge.

Throughout county. Common.

E. marginata Pursh. White-margined Spurge.

Reported from one locality in Cudahy. Probably escaped from cultivation.

E. Helioscopia L. Sun Spurge.

Collected in county by Dr. Hasse.

E. Peplus L. Petty Spurge.

City gardens and waste places. Sparse.

E. Cyparissias L. Cypress Spurge.

Wauwatosa. Along roadsides. Gregarious.

CALLITRICHACEÆ.

- Callitriche verna** L. *C. palustris* L. Water Starwort.
Southern part of county.

LIMNANTHACEÆ.

- Flœrkea proserpinacoides** Willd. False Mermaid.
Reynolds' Woods. Sec. 21, Greenfield. Dominant and copious.

ANACARDIACEÆ.

- Rhus typhina** L. *R. hirta* (L.) Sudw. Staghorn Sumac.
Eastern portion of county. Common.
- R. glabra** L. Smooth Sumac.
Western portion of county. Common.
- R. Vernix** L. Poison Sumac.
Near St. Francis and New Coeln. Rapidly disappearing.
- R. Toxicodendron** L. var. **radicans** Torr. *R. radicans* L. Poison Ivy.
Reynolds' Woods and New Coeln. Not common.
- R. microcarpa** (Michx.) Steud. Northern Poison Oak.
Throughout county. Common.

AQUIFOLIACEÆ.

ILICACEÆ.

- Ilex verticillata** (L.) Gray. Black Alder.
In southern part of county and formerly near Whitefish Bay,
also in Town of Granville. Rare.
- I. lævigata** (Pursh.) Gray. Smooth Winter-berry.
Specimen in Public Museum herbarium, collected at New
Coeln by T. A. Bruhin.

CELASTRACEÆ.

- Euonymus atropurpureus** Jacq. Burning Bush.
Sec. 27, Wauwatosa; Secs. 11 and 12, Greenfield; Sec. 22, Oak
Creek. Sparse.
- Celastrus scandens** L. Bittersweet.
Throughout county. Locally abundant.

ACERACEÆ.

- Acer saccharinum** L. Silver Maple.
Planted as a shade tree along streets.
- A. rubrum** L. Red Maple.
Throughout county. Not uncommon.
- A. saccharum** Marsh. Sugar Maple.
Throughout county. Common.
- A. Saccharum** var. **nigrum** (Michx.) Britton. *A. nigrum* Michx.
Black Sugar Maple.
Throughout county. Not uncommon.
- A. spicatum** Lam. Mountain Maple.
One locality in Sec. 29, Town of Milwaukee. Numerous.
- A. Negundo** L. Box Elder.
Occasionally escaped from cultivation.

SAPINDACEÆ.

HIPPOCASTANACEÆ.

- Aesculus Hippocastanum** L. Horse-chestnut.
Commonly planted as a shade tree.
- Ae. glabra** Willd. Fetid Buckeye.
Rarely planted as a shade tree.
- Ae. octandra** Marsh. Yellow Buckeye.
Rarely planted as a shade tree.

BALSAMINACEÆ.

- Impatiens biflora** Walt. Spotted Touch-me-not.
Throughout county. Abundant.
- I. pallida** Nutt. *I. aurea* Muhl. Pale Touch-me-not.
Secs. 18 and 29, Town of Milwaukee. Not abundant.

RHAMNACEÆ.

- Rhamnus cathartica** L. Buckthorn.
Escaped from cultivation. Wauwatosa and Town of Milwaukee.
- R. alnifolia** L'Her. Alder-leaved Buckthorn. Merrill Park. West
end of Wells Str. viaduct. Formerly in Sec. 1, Greenfield.
- Ceanothus americanus** L. New Jersey Tea.
In south and west parts of county. Locally abundant.

VITACEÆ.

- Vitis æstivalis** Michx. Summer Grape.
Throughout county. Not common.
- V. cordifolia** Michx. Frost Grape.
Menomonee Valley.
- V. vulpina** L. Riverside Grape.
Menomonee Valley.
- Ampelopsis quinquefolia** (L.) Michx. *Parthenocissus quinquefolia* (L.)
Planch. Virginia Creeper. Throughout county. Common.

TILIACEÆ.

- Tilia americana** L. Basswood. Linden.
Throughout county. Common.

MALVACEÆ.

- Malva sylvestris** L. High Mallow.
A garden weed, escaping to woods.
- M. rotundifolia** L. Cheeses. Dwarf Mallow.
A common weed.
- M. moschata** L. Musk Mallow.
In southern part of county. Common.
- Abutilon Theophrasti** Medic. *A. Abutilon* (L.) Rusby. Velvet Leaf.
A weed in gardens and along roads.
- Hibiscus Trionum** L. Bladder Ketmia.
Escaped from gardens in southern part of county.

HYPERICACEÆ.

- Hypericum Ascyron** L. Great St. John's-wort.
Throughout county. Occasional.
- H. perforatum** L. Common St. John's-wort.
Near Forest Home Cemetery.
- H. maculatum** Walt. Spotted St. John's-wort.
Wauwatosa.
- H. canadense** L. Canadian St. John's-wort.
Wauwatosa.
- H. virginicum** L. *Triadenum virginicum* (L.) Raf.
Marsh St. John's-wort. Near New Coeln.

VIOLACEÆ.

- Viola sororia** Willd. *V. cuspidata* Greene. Common Blue Violet.
Abundant throughout county.
- V. subsagittata** Greene. (Western form of *V. sagittata* Ait.)
Arrow-leaved Violet. Reported from one locality in Wauwatosa and one in Oak Creek.
- V. cucullata** Ait. Marsh Blue Violet.
In open grassy marshes. Rare.
- V. affinis** Le Conte. Thin-leaved Wood Violet.
In rich wet woods. Not common.
- V. conspersa** Reichenb. *V. labradorica* Schrank. Dog Violet.
Common.
- V. pubescens** Ait. Hairy Yellow Violet.
Not common.
- V. scabriuscula** Schwein. Smoother Yellow Violet.
Abundant throughout county.
- V. blanda** Willd. Woodland White Violet.
Abundant locally in cold damp woods.
- V. lanceolata** L. Lance-leaved Violet.
Given in Wheeler's list on authority of Dr. L. Sherman. Not reported since.

THYMELEACEÆ.

- Dirca palustris** L. Leather-wood.
Occasional throughout county.

ELÆAGNACEÆ.

- Shepardia canadensis** (L.) Nutt. *Lepargyrea Canadensis* (L.) Greene.
Canadian Buffalo-berry. Banks of Milwaukee river and bluffs of lake shore. Locally abundant.

LYTHRACEÆ.

- Lythrum alatum** Pursh. Wing-angled Loosestrife.
North line of Sec. 33, Town of Franklin.

ONAGRACEÆ.

Ludwigia palustris (L.) Ell. *Isnardia palustris* L. Marsh Purslane.

Southern part of county. Locally abundant.

L. polycarpa Short & Peter. Ludwigia.

Very common near New Coeln.

Epilobium angustifolium L. *Chamaenerion angustifolium* (L.) Scop.

Great Willow-herb. Fire-weed. North of Whitefish Bay and occasional elsewhere. Gregarious.

E. coloratum Muhl. Purple-leaved Willow-herb.

Throughout county. Common.

E. alpinum L. var. **fontanum** Wahlenb. *E. Hornemanni* Reichenb.

Alpine Willow-herb.

Reported from Sec. 18, Town of Milwaukee.

Oenothera cruciata Nutt. *Onagra cruciata* (Nutt.) Small.

Small-flowered Evening Primrose.

A single specimen from near Whitefish Bay.

Oe. biennis L. *Onagra biennis* (L.) Scop. Common Evening Primrose

Throughout county. Common.

Oe. biennis L. var. **Oakesiana** Gray. *Onagra Oakesiana* (Gray.)

Britton. Oakes' Evening-Primrose.

In southern part of county. Not uncommon.

Oe. rhombipetala Nutt. Rhombic Evening-Primrose.

Railway tracks near Juneau Park.

Oe. pallida Lindl. *Anogra pallida* (Lindl.) Britton.

White-stemmed Evening Primrose.

Near the city limits and the Kinnickinnic River.

Gaura biennis L. Biennial Gaura.

In Menomonee Valley near Grant Marble Works.

Circæa Lutetiana L. Enchanter's Nightshade.

Throughout county. Common.

C. alpina L. Smaller Enchanter's Nightshade.

Throughout county. Common.

HALORAGIDACEÆ.

Proserpinaca palustris L. Mermaid-weed.

Swamps in Menomonee and Kinnickinnic Valleys.

Myriophyllum spicatum L. Spiked Water-milfoil.

Throughout county. Common.

ARALIACEÆ.

Aralia racemosa L. Spikenard.

Throughout county. Not uncommon.

A. nudicaulis L. Wild Sarsaparilla.

Throughout county. Occasional.

Panax quinquefolium L. Ginseng.

In southern part of county. Occasional.

P. trifolium L. Dwarf Ginseng.

Throughout county. Occasional.

UMBELLIFERÆ.

Sanicula marylandica L. Black Snake-root.

Common.

S. gregaria Bicknell. Clustered Snake-root.

Reynolds Woods. Town of Greenfield.

S. canadensis L. Short-styled Snake-root.

Locally abundant.

S. trifoliata Bicknell. Large-fruited Snake-root.

Throughout county. Rare.

Eryngium aquaticum L. Button Snake-root.

Southern part of county. Occasional.

Osmorhiza Claytoni (Michx.) Clarke. *Washingtonia Claytoni* (Michx.)

Britton. Woolly Sweet-cicely. Throughout county. Common.

O. longistylis DC. *Washingtonia longistylis* (Torr.) Britton.

Smoother Sweet-cicely. Throughout county. Occasional.

Erigenia bulbosa (Michx.) Nutt. Harbinger of Spring.

Wauwatosa. Locally abundant.

Cicuta maculata L. Water Hemlock.

Menomonee Valley and Milwaukee River. Locally abundant.

C. bulbifera L. Bulb-bearing Water Hemlock.
Menomonee Valley.

Cryptotaenia canadensis (L.) DC. *Deringia Canadensis* (L.) Kuntze.
Honewort. Throughout county. Common.

Carum Carui L. Caraway.
Escaped from cultivation. Common.

Tænidia integerrima (L.) Drude. Yellow Pimpernel.
Throughout county. Locally abundant.

Sium cicutæfolium Gmel. Hemlock Water-parsnip.
Southern and western parts of county. Common.

Thaspium aureum Nutt. var. **atropurpureum** Coult. & Rose. *T. trifoliatum* (L.) Britton. Purple Meadow Parsnip.
South and west. Locally abundant.

Conioselinum chinense (L.) B. S. P. Hemlock Parsley.
Throughout county. Not common.

Angelica atropurpurea L. Angelica.
Throughout county. Common.

Polytaenia Nuttallii DC. Polytaenia.
Menomonee Valley.

Tiedemannia rigida Coult. & Rose. *Orypolis rigidus* (L.) Raf.
Cowbane. Hemlock. Wauwatosa.

Pastinaca sativa L. Wild Parsnip.
Very common.

Heracleum lanatum Michx. Cow-parsnip.
Common.

CORNACEÆ.

Cornus canadensis L. Dwarf Cornel.
West of North Greenfield and north of Whitefish Bay. Once abundant in Sec. 1, Greenfield.

C. circinata L'Her. Round-leaved Dogwood.
Throughout county. Not common.

C. Amomum Mill. Kinnikinnik. Silky Dogwood.
Throughout county. Common.

- C. stolonifera** Michx. Red Osier Dogwood.
Throughout county. Common.
- C. paniculata** L'Her. *C. candidissima* Marsh. Panicked Dogwood.
Throughout county. Common.
- C. alternifolia** L. f. Alternate-leaved Dogwood.
Wauwatosa and Whitefish Bay.

ERICACEÆ.

PYROLIACEÆ.

- Pyrola americana** Sweet. *P. rotundifolia* L. Round-leaved Wintergreen.
Whitefish Bay. Formerly also Sec. 1, Greenfield.
- P. elliptica** Nutt. Shin-leaf.
Near lake, Whitefish Bay and Town of Lake.
- P. asarifolia** Michx. var. *incarnata* (Fisch.) Fernald. *P. uliginosa*
Torr. Bog Wintergreen. Whitefish Bay. Locally abundant.
- P. secunda** L. Serrated Wintergreen.
Whitefish Bay.

MONOTROPACEÆ.

- Monotropa uniflora** L. Indian Pipe.
Throughout county. Rare.

ERICACEÆ.

- Gaultheria procumbens** L. Creeping Wintergreen.
North of Whitefish Bay.
- Arctostaphylos Uva-ursi** (L.) Spreng. Red Bearberry.
On bluff north of Whitefish Bay. Rare.

VACCINIACEÆ.

- Gaylussacia resinosa** (Ait.) T. & G. High-bush Huckleberry.
Near New Coeln.
- Vaccinium corymbosum** L. Tall Blueberry.
Reported only from Sec. 1, Greenfield.
- V. pennsylvanicum** Lam. Dwarf Blueberry.
Near New Coeln and Whitefish Bay.
- V. macrocarpon** Ait. *Oxycoccus macrocarpus* (Ait.) Pers. Large
Cranberry. Reported from a small lake in Sec. 1, Franklin.

PRIMULACEÆ.

Samolus floribundus H B K. Water Pimpernel.
Near Layton Park.

Steironema ciliatum (L.) Raf. Fringed Loosestrife.
Throughout county. Common.

S. quadriflorum (Sims.) Hitch. Prairie Moneywort.
Near the cement works on Milwaukee River.

Lysimachia thyrsiflora L. *Naumburgia thyrsiflora* (L.) Duby.
Tufted Loosestrife. South and west. Not common.

Trientalis americana (Pers.) Pursh. Star Flower.
Throughout county. Locally abundant.

Anagallis arvensis L. Scarlet Pimpernel.
Hawley Road south of National Ave.

Dodecatheon Meadia L. Shooting Star.
Throughout county. Occasional.

OLEACEÆ.

Fraxinus americana L. White Ash.
Throughout county. Common.

F. pennsylvanica Marsh. Red Ash.
Throughout county. Occasional.

F. pennsylvanica Marsh. var. **lanceolata** (Borck.) Sargent. *F. lanceolata* Borck. Green Ash. Lake Woods and Whitefish Bay.

F. nigra Marsh. Black Ash.
Throughout county. Common.

GENTIANACEÆ.

Gentiana crinita Froel. Fringed Gentian.
Throughout county. Locally abundant.

G. quinquefolia L. Stiff Gentian.
Milwaukee River near cement works, also Bay View near lake.

G. quinquefolia var. **occidentalis** (Gray.) A. S. Hitchcock.
Same as last.

G. saponaria L. Soap-wort Gentian. Specimen in Public Museum
herbarium collected in Wauwatosa by W. M. Wheeler.

G. Andrewsii Griseb. Blind Gentian.
Throughout county. Occasional.

G. flavida Gray. Yellowish Gentian.
Fox Point. Sparse.

MENYANTHACEÆ.

Menyanthes trifoliata L. Buckbean.
Reported from Sec. 1, Greenfield. Probably now extinct.

APOCYNACEÆ.

Apocynum androsæmifolium L. Spreading Dogbane.
Throughout county. Common.

A. cannabinum L. Indian Hemp.
Wauwatosa and Town of Milwaukee.

A. cannabinum L. var. **hypericifolium** (Ait.) Gray. *A. hypericifolium* Ait.
Near Pilgrims Rest Cemetery, according to Bennetts.

ASCLEPIADACEÆ.

Asclepias tuberosa L. Butterfly-weed.
Oak Creek. Reported once.

A. purpurascens L. Purple Milkweed.
Southwestern part of county. Occasional.

A. incarnata L. Swamp Milkweed.
Throughout county. Common.

A. phytolaccoides Pursh. *A. exaltata* (L.) Muhl. Poke Milkweed.
Throughout county. Common west.

A. syriaca L. Common Milkweed.
Throughout county. Common.

CONVOLVULACEÆ.

Ipomœa purpurea (L.) Roth. Morning Glory.
Escaped from cultivation. Occasional.

I. hederacea Jacq. Ivy-leaved Morning Glory.
Menomonee Valley, foot of 17th Str.

Convolvulus sepium L. Great Bindweed.

Throughout county. Common.

C. spithameus L. Upright Bindweed.

Wauwatosa and Whitefish Bay. Locally abundant.

C. arvensis L. Small Bindweed.

On bank of Juneau Park and in neighboring gardens.

CUSCUTACEÆ.

Cuscuta obtusiflora HBK. *C. polygonorum* Engelm. Smartweed Dodder.

Menomonee Valley and near New Coeln.

C. Gronovii Willd. Love-vine.

Throughout county. Occasional.

POLEMONIACEÆ.

Phlox pilosa L. Downy Phlox.

Wauwatosa and Oak Creek. Locally common.

P. divaricata L. Blue Phlox.

Throughout county. Common.

Polemonium reptans L. Greek Valerian.

Throughout county. Common.

HYDROPHYLLACEÆ.

Hydrophyllum virginicum L. Water-leaf.

Throughout county. Common.

BORAGINACEÆ.

Cynoglossum officinale L. Hound's-tongue.

Common everywhere.

C. virginicum L. Wild Comfrey.

Bay View and lower part of 18th Ward, city. Not common.

Lappula Myosotis Moench. *L. Lappula* (L.) Karst. Stickseed.

Wauwatosa.

L. virginiana (L.) Greene. Virginia Stickseed.

Common everywhere.

Myosotis palustris (L.) Lam. Forget-me-not.

Bay View.

Lithospermum officinale L. Gromwell.

Wauwatosa, Menomonee Valley near Merrill Park.

L. latifolium Michx. American Gromwell.

Wauwatosa.

L. Gmelini (Michx.) A. S. Hitchcock. Hairy Puccoon.

Southern part of county. Occasional.

L. canescens (Michx.) Lehm. Hoary Puccoon.

West of North Greenfield along R. R. tracks. Not numerous.

Onosmodium carolinianum (Lam.) DC. False Gromwell.

Once found by T. A. Bruhin in Sec. 4, Oak Creek.

Symphytum officinale L. Comfrey. In southern and western parts of county and in waste places in city. Occasional.

Echium vulgare L. Blue-weed. Viper's Bugloss.

Formerly along C. & N. W. R. R. tracks near Mineral Spring Park. Now extinct in that locality.

VERBENACEÆ.

Verbena urticaefolia L. White Vervain.

Throughout county. Common.

V. hastata L. Blue Vervain.

Throughout county. Common.

V. stricta Vent. Mullen-leaved Vervain.

Along R. R. tracks. West of Layton Park, also Menomonee Valley near 21st Ave.

V. bracteosa Michx. Large-bracted Vervain.

Along R. R. tracks. Juneau Park, Bay View and Menomonee Valley, also west of Wauwatosa. Locally abundant.

LABIATÆ.

Teucrium canadense L. Wood Sage.

Throughout county. Occasional.

Scutellaria lateriflora L. Mad-dog Skullcap.

Wauwatosa and banks of Milwaukee River.

- S. versicolor** Nutt. *S. cordifolia* Muhl. Heart-leaved Skullcap.
Wauwatosa, Oak Creek and Franklin.
- S. galericulata** L. Marsh Skullcap.
In southern part of county.
- Agastache scrophulariæfolia** (Willd.) Kuntze. Giant Hyssop.
In southern and western parts of county. Occasional.
- Nepeta Cataria** L. Catnep.
Throughout county. Common.
- N. Glechoma** Benth. *Glechoma hederacea* L. Ground Ivy.
Throughout county. Locally abundant.
- Prunella vulgaris** L. Heal-all.
Everywhere.
- Physostegia virginiana** (L.) Benth. Lion's Heart.
Throughout county. Occasional.
- P. parviflora** Nutt. Purple Lion's Heart.
Menomonee Valley near Merrill Park.
- Galeopsis Ladanum** L. Red Hemp-nettle. Specimen in Public Museum
herbarium, collected by F. Runge.
- G. Tetrahit** L. Hemp-nettle.
Once found by T. A. Bruhin near New Coeln.
- Leonurus Cardiaca** L. Motherwort.
Throughout county. Common.
- Lamium amplexicaule** L. Henbit.
City gardens and waste places. Locally abundant.
- Stachys aspera** Michx. Rough Hedge-nettle.
Throughout county. Locally abundant.
- S. aspera** Michx. var. **glabra** Gray. *S. tenuifolia* Willd.
Smooth Hedge-nettle. West of Village of Wauwatosa.
- Monarda fistulosa** L. Wild Bergamot.
Throughout county. Common.
- Blephilia ciliata** (L.) Raf. Downy Blephilia.
Wauwatosa.
- B. hirsuta** (Pursh.) Torr. Hairy Blephilia.
In southern and western parts of county. Occasional.

- Hedeoma pulegioides** (L.) Pers. American Pennyroyal.
Throughout county. Locally abundant.
- H. hispida** Pursh. Rough Pennyroyal.
Near Whitefish Bay. One locality.
- Pycnanthemum lanceolatum** Pursh. *Koellia Virginiana* (L.) Mac M.
Mountain Mint. One locality on bank of Milwaukee River.
- Lycopus virginicus** L. Purple Bugle-weed.
Menomonee Valley in Wauwatosa. Locally abundant.
- L. rubellus** Moench. Water Hoarhound.
Wauwatosa and Town of Milwaukee. Occasional.
- L. europæus** L. var. **sinuatus** Gray. *L. Americanus* Muhl.
Cut-leaved Water Hoarhound. Wauwatosa. Locally abundant.
- Mentha viridis** L. *M. spicata* L. Spearmint.
In southern part of county.
- M. arvensis** L. Corn Mint.
Near New Coeln.
- M. arvensis** var. **canadensis** (L.) Briq. *M. Canadensis* L. Wild Mint.
Throughout county. Common.

SOLANACEÆ.

- Physalis pubescens** L. Hairy Ground-cherry.
Whitefish Bay. Common.
- P. virginiana** Mill. Virginia Ground-cherry.
Sec. 34, Greenfield. Abundant.
- P. heterophylla** Nees. Clammy Ground-cherry.
Sec. 9, Oak Creek. Sparse.
- Solanum nigrum** L. Black Nightshade.
Everywhere.
- S. triflorum** Nutt. Cut-leaved Nightshade.
Waste places in city. Occasional.
- S. carolinense** L. Horse-nettle.
Waste places in city. Occasional.
- S. rostratum** Dunal. Sand Bur.
Waste places in city. Occasional.

S. Dulcamara L. Bittersweet.

Throughout county. Not uncommon.

Lycium halimifolium Mill. *L. vulgare* (Ait. f.) Dunal. Matrimony-vine.

Escaped from cultivation. Occasional.

Hyoscyamus niger L. Black Henbane.

A single specimen from Menomonee Valley reported by F. Runge.

Datura Stramonium L. Jimson-weed.

Throughout county. Rare.

D. Tatula L. Purple Stramonium.

Waste places in city. Rare.

D. Metel L. Entire-leaved Stramonium.

Waste places in city. Occasional.

Nicotiana rustica L. Wild Tobacco.

New Coeln and Menomonee Valley. Reported twice.

SCROPHULARIACEÆ.

Verbascum Thapsus L. Great Mullen.

Common.

V. Blattaria L. Moth Mullen.

Menomonee Valley near Merrill Park.

Linaria Cymbalaria (L.) Mill. *Cymbalaria Cymbalaria* (L.) Wettst.

Kennilworth Ivy. A weed in gardens.

L. vulgaris Mill. *L. Linaria* (L.) Karst. Toad-flax.

Throughout county. Common.

Scrophularia marylandica L. Figwort.

Locally common.

Chelone glabra L. Turtlehead.

Throughout county. Common.

Pentstemon hirsutus (L.) Willd. Hairy Beard-tongue.

Near Milwaukee River. Locally abundant.

P. lævigatus Soland. var. **Digitalis** (Sweet.) Gray. *P. Digitalis* (Sweet.) Nutt. Fox-glove Beard-tongue.

Wauwatosa and Whitefish Bay. Rare.

Mimulus ringens L. Monkey-flower.

Throughout county. Common.

- Veronica Anagallis-aquatica** L. Water Speedwell.
Sec. 1, Greenfield, and Sec. 32, Town of Milwaukee.
- V. americana** Schwein. American Brooklime.
Near New Coeln.
- V. scutellata** L. Skullcap Speedwell.
In southern and western parts of county. Common.
- V. serpyllifolia** L. Thyme-leaved Speedwell.
In lawns in city and near Soldiers' Home.
- V. peregrina** L. Purslane Speedwell. Neckweed.
Near Soldiers' Home.
- V. arvensis** L. Corn Speedwell.
Whitefish Bay and on National Ave.
- V. Byzantina** (Sibth. & Smith) B. S. P. Byzantine Speedwell.
A weed in city gardens and at Fox Point.
- V. virginica** L. *Leptandra Virginica* (L.) Nutt. Culver's Root.
Throughout county. Occasional.
- Gerardia grandiflora** Benth. *Dasystoma grandiflora* (Benth.) Wood.
Western False-Foxglove. Bay View. Rare.
- G. tenuifolia** Vahl. Slender Gerardia.
In northern and western parts of county. Not common.
- Castilleja coccinea** (L.) Spreng. Scarlet Painted-cup.
Throughout county. Not common.
- Pedicularis lanceolata** Michx. Swamp Lousewort.
Throughout county. Common.
- P. canadensis** L. Wood Betony. Lousewort.
Throughout county. Common.
- Melampyrum lineare** Lam. Cow-wheat.
Whitefish Bay.

LENTIBULARIACEÆ.

- Utricularia vulgaris** L. Greater Bladderwort.
"In a pool near Soldiers' Home." Wheeler.

OROBANCHACEÆ.

Orobanche uniflora L. *Thalesia uniflora* (L.) Britton. Broom Rape.
North of Whitefish Bay and banks of Milwaukee River.

Conopholis americana (L. f.) Wallr. Squaw-root. Oak Creek and
banks of Milwaukee River, also Town of Greenfield.

Epiphegus virginiana (L.) Bart. *Leptamnium Virginianum* (L.) Raf.
Beech Drops. Throughout county. Locally abundant.

PHRYMACEÆ.

Phryma Leptostachya L. Lopseed.
Throughout county. Common.

PLANTAGINACEÆ.

Plantago major L. Common Plantain.
Everywhere.

P. Rugelii Dec. Rugels' Plantain.
Throughout county. Fairly common.

P. lanceolata L. Ribwort.
In lawns in city. Along roadside Franklin. Occasional.

P. cordata Lam. Heart-leaved Plantain.
Wauwatosa and Oak Creek.

P. Purshii R. & S. Pursh's Plantain.
Whitefish Bay. One locality.

RUBIACEÆ.

Mitchella repens L. Partridge-berry.
Near New Coeln.

Cephalanthus occidentalis L. Button Bush.
Towns of Milwaukee, Greenfield, Oak Creek and Franklin.
Occasional.

Galium verum L. Yellow Bed-straw.
Near Hopkins Road, Wauwatosa.

G. Aparine L. Cleavers. Goose-grass.
In southern and western parts of county. Occasional.

- G. circæzans** Michx. Wild Liquorice. Castalia Park and Black's Woods in Wauwatosa, also Bay View and St. Francis. Sparse.
- G. boreale** L. Northern Bedstraw.
Near the Cement Mills, Milwaukee River. Abundant.
- G. triflorum** Michx. Fragrant Bedstraw.
In southern and western parts of county. Common.
- G. tinctorium** L. Stiff Marsh Bedstraw.
Sec. 18, Town of Milwaukee.
- G. trifidum** L. Small Bedstraw.
Sec. 1, Greenfield.
- G. concinnum** T. & G. Shining Bedstraw.
Reported from Wauwatosa.
- G. asprellum** Michx. Rough Bedstraw.
In southern and western parts of county. Not uncommon.

CAPRIFOLIACEÆ.

- Sambucus canadensis** L. Sweet Elder.
Throughout county. Common.
- S. racemosa** L. *S. pubens* Michx. Red-berried Elder.
Common in Town of Milwaukee. Rare in southwestern part of county.
- Viburnum Opulus** L. High Bush-cranberry.
In southern and western parts of county. Not uncommon.
- V. acerifolium** L. Dockmakie.
Throughout county. Common.
- V. pubescens** (Ait.) Pursh. Downy-leaved Arrow-wood.
Town of Milwaukee and southern part of county. Occasional.
- V. dentatum** L. Arrow-wood.
Throughout county. Not uncommon.
- V. cassinoides** L. Withe-rod.
Whitefish Bay.
- V. Lentago** L. Nanny-berry.
Near New Coeln and Whitefish Bay. Occasional.
- Triosteum perfoliatum** L. Horse Gentian.
Throughout county. Common.

Linnæa borealis L. var. **americana** (Forbes.) Rehder. *L. Americana* Forbes. Twin-flower. Reported from Sec. 1, Town of Greenfield, also from New Coeln.

Symphoricarpos racemosus Michx. Snowberry.
Throughout county. Common.

S. occidentalis Hook. Wolfberry.
Menomonee Valley and North Greenfield. Abundant.

Lonicera dioica L. Smooth-leaved Honeysuckle.
Throughout county. Locally abundant.

L. Sullivantii Gray. Sullivant's Honeysuckle.
Throughout county. Common.

L. flava Sims. Yellow Honeysuckle.
Reported by Wheeler as common in southern part of county.
Probably confused with *L. Sullivantii*.

L. japonica Thumb. Japanese Honeysuckle.
Occasionally escaped from cultivation.

L. oblongifolia (Goldie.) Hook. Swamp Fly-Honeysuckle.
New Coeln and Menomonee Valley. Occasional.

L. canadensis Marsh. *L. ciliata* Muhl. American Fly-Honeysuckle.
Throughout county. Common.

L. tatarica L. Tartarian Bush-Honeysuckle.
Occasionally escaped from cultivation.

Diervilla trifida Moench. *D. Diervilla* (L.) Mac M. Bush-Honeysuckle.
Throughout county. Common.

VALERIANACEÆ.

Valeriana edulis Nutt. Valerian.
Menomonee Valley. Occasional.

CUCURBITACEÆ.

Echinocystis lobata (Michx.) T. & G. *Micrampelis lobata* (Michx.) Greene. Mock Apple. Throughout county. Common.

Cyclanthera dissecta (T. & G.) Arn. Cyclanthera. Reported by W. J. Bennetts from Menomonee Valley, foot of 23rd Str.

CAMPANULACEÆ.

Campanula rotundifolia L. Harebell.

Menomonee Valley. Near Cement Mills on Milwaukee River,
also Town of Milwaukee. Occasional.

C. rapunculoides L. Creeping Bell-flower. A single plant in a vacant lot on Prospect Ave. No longer there.**C. aparinoides** Pursh. Marsh Bell-flower.

Sec. 1, Greenfield, and Secs. 15 and 22, Oak Creek.

C. americana L. Tall Bell-flower.

Throughout county. Locally abundant.

LOBELIACEÆ.

Lobelia cardinalis L. Cardinal Flower. Town of Granville. Lake bank north of Whitefish Bay. Reynolds Woods, (S. W. $\frac{1}{4}$ Sec. 12, Greenfield). Formerly in other parts of county.**L. syphilitica** L. Great Lobelia.

Throughout county. Common.

L. spicata Lam. Pale Spiked Lobelia.

Oak Creek. Franklin. Whitefish Bay. Not common.

L. inflata L. Indian Tobacco.

Throughout county. Common.

L. Kalmii L. Brook Lobelia.

Near the Cement Mills on Milwaukee River.

COMPOSITÆ.

CICHORIACEÆ.

Cichorium Intybus L. Chicory.

Throughout county. Locally abundant.

Lapsana communis L. Nipplewort.

In a vacant lot in 7th Ward. Copious.

Krigia virginica (L.) Willd. *Adopogon Virginicum* (L.) Kuntze. Cynthia.

Menomonee Valley and Whitefish Bay. Locally common.

Tragopogon pratensis L. Yellow Goats-beard.

Escaped from cultivation. Occasional.

T. porrifolius L. Oyster Plant. Menomonee Valley and along
C. & N. W. R. R. tracks near lake. Occasional.

Taraxacum officinale Weber. *T. Taraxacum* (L.) Karst. Dandelion.
Everywhere.

Sonchus arvensis L. Corn Sow-thistle.
Throughout county. Common.

S. oleraceus L. Annual Sow-thistle.
Throughout county. Common.

S. asper (L.) All. Spiny Sow-thistle.
Throughout county. Common.

Lactuca scariola var. *integrata* Gren. & Godr. Prickly Lettuce.
A weed everywhere. Incorrectly referred to as *L. virosa* L.
in Britton's Manual.

L. ludoviciana (Nutt.) DC. Western Lettuce.
Near swamp at New Coeln. Occasional.

L. canadensis L. Tall Lettuce.
Throughout county. Common.

L. canadensis L. var. *integrifolia* (Bigel.) Gray. *L. sagittifolia* Ell.
Arrow-leaved Lettuce.
Wauwatosa and Whitefish Bay. Not uncommon.

L. hirsuta Muhl. Hairy Wood Lettuce.
Wauwatosa. Occasional.

L. pulchella (Pursh.) DC. Large-flowered Blue Lettuce.
Near swamp at New Coeln. Rare.

L. floridana (L.) Gaertn. False Lettuce.
Near Milwaukee River above city limits.

Hieracium venosum L. Rattlesnake-weed.
Near New Coeln and in Lake Woods.

H. canadense Michx. Canada Hawkweed.
Wauwatosa and Whitefish Bay. Occasional.

H. scabrum Michx. Rough Hawkweed.
Wauwatosa, Oak Creek and Lake Woods.

Prenanthes alba L. *Nabulus albus* (L.) Hook. White Lettuce.
Throughout county. Common.

AMBROSIACEAE.

- Iva xanthifolia** (Fresen.) Nutt. Marsh Elder.
Waste places in Menomonee Valley, also in Third and Fifth
Wards. Locally abundant.
- Ambrosia trifida** L. Great Ragweed.
Throughout county. Locally abundant.
- A. trifida** var. **integrifolia** (Muhl.) T. & G.
Throughout county. With the preceding.
- A. artemisiifolia** L. Ragweed.
Everywhere.
- A. psilostachya** DC. Western Ragweed.
Menomonee Valley. Not common.
- Franseria Hookeriana** Nutt. *Gaertneria acanthicarpa* (Hook.) Britton.
Franzeria. Menomonee Valley, along railroad tracks.
- Xanthium strumarium** L. *X. glabratum* (DC.) Britton.
Smootish Cocklebur. Throughout county. Common.
- X. pennsylvanicum** Wallr. Pennsylvania Clotbur.
Waste places and along railroad tracks. Occasional.

COMPOSITAE.

- Vernonia fasciculata** Michx. Western Iron-weed.
Menomonee Valley and Oak Creek. Locally abundant.
- Eupatorium purpureum** L. Joe-pye Weed.
Throughout county. Common.
- E. perfoliatum** L. Boneset.
Throughout county. Common.
- E. ageratoides** L. f. White Snake-root.
Throughout county. Not uncommon.
- Liatris pycnostachya** Michx. *Lacinaria pycnostachya* (Michx.) Kuntze.
Prairie Button Snake-root.
Menomonee Valley, Wauwatosa. Not common.
- L. spicata** Willd. *Lacinaria spicata* (L.) Kuntze. Gay Feather.
Bay View. Locally abundant.
- Grindelia squarrosa** (Pursh.) Dunal. Broad-leaved Gum-plant.
Granville. Wauwatosa. Becoming common.

- Solidago caesia** L. Blue-stemmed Goldenrod.
Near New Coeln and Bay View.
- S. latifolia** L. *S. flexicaulis* L. Broad-leaved Goldenrod.
Throughout county. Locally abundant.
- S. stricta** Ait. Willow-leaved Goldenrod.
In southern part of county.
- S. speciosa** Nutt. Showy Goldenrod.
Bay View.
- S. rugosa** Mill. Hairy Goldenrod.
Wauwatosa, Granville & Milwaukee River near Cement Wks.
- S. patula** Muhl. Rough-leaved Goldenrod.
Whitefish Bay and Wauwatosa. Locally abundant.
- S. ulmifolia** Muhl. Elm-leaved Goldenrod.
Whitefish Bay and Wauwatosa. Not uncommon.
- S. neglecta** T. & G. Swamp Goldenrod.
Bay View and Menomonee Valley.
- S. juncea** var. *scabrella* (T. & G.) Gray. Sharp-toothed Goldenrod.
Wauwatosa and Whitefish Bay. Locally abundant.
- S. arguta** Ait. Cut-leaved Goldenrod.
Wauwatosa and northern part of county.
- S. serotina** Ait. Late Goldenrod.
Occasional. North and south.
- S. canadensis** L. Canada Goldenrod.
Throughout county. Common.
- S. nemoralis** Ait. Field Goldenrod.
Throughout county. Not uncommon.
- S. rigida** L. Stiff Goldenrod.
Town of Franklin and Milwaukee River near Cement Works.
- S. ohioensis** Riddell. Ohio Goldenrod.
Menomonee Valley, Wauwatosa.
- S. Riddellii** Frank. Riddell's Goldenrod.
North of city.
- S. Houghtonii** T. & G. Houghton's Goldenrod.
Reported by Dr. L. Sherman.

- S. graminifolia** (L.) Ell. *Euthamia graminifolia* (L.) Nutt.
Fragrant Goldenrod.
Whitefish Bay and New Coeln. Locally abundant.
- Boltonia asteroides** (L.) L'Her. Aster-like Boltonia.
Sec. 21, Town of Lake; Sec. 33, Oak Creek. Abundant.
- Sericocarpus linifolius** (L.) B. S. P. Narrow-leaved White-topped Aster.
Near North Milwaukee.
- Aster divaricatus** L. White Wood Aster.
Banks of Milwaukee River.
- A. leptocaulis** Burgess. Smooth-stemmed Aster.
Lake Woods and Whitefish Bay.
- A. macrophyllus** L. Large-leaved Aster.
Throughout county. Locally abundant.
- A. Shortii** Hook. Short's Aster.
Throughout northern part of county. Locally abundant.
- A. azureus** Lindl. Sky-blue Aster.
Menomonee Valley and Milwaukee River. Occasional.
- A. cordifolius** L. Common Blue Wood Aster.
Throughout county. Locally abundant.
- A. cordifolius** L. var. *laevigatus* Porter. *A. Lowricanus* Porter.
Smooth Wood Aster. Throughout county. Common.
- A. sagittifolius** Willd. Arrow-leaved Aster.
Reported by A. Conrath as found in county.
- A. Drummondii** Lindl. Drummond's Aster.
Wauwatosa and Whitefish Bay. Locally abundant.
- A. undulatus** L. Wavy-leaved Aster.
Whitefish Bay and New Coeln.
- A. novæ-angliæ** L. New England Aster. Near the Cement Works,
at Lake Woods and Whitefish Bay. Locally abundant.
- A. puniceus** L. Red-stalk Aster.
Throughout county. Common.
- A. puniceus** var. *lucidulus* Gray.
Sec. 5, Greenfield.
- A. prenanthoides** Muhl. Crooked-stem Aster.
Throughout county. Not uncommon.

- A. laevis** L. Smooth Aster.
Throughout county. Abundant, especially north.
- A. junceus** Ait. Rush Aster.
In western part of county. Locally abundant.
- A. longifolius** Lam. Long-leaved Aster.
Whitefish Bay.
- A. ptarmicoides** (Nees.) T. & G. Upland White Aster.
Sec. 1, Greenfield.
- A. paniculatus** Lam. Panicked Aster.
Banks of Milwaukee River.
- A. paniculatus** var. **simplex** (Willd.) Burgess.
Sec. 1, Greenfield.
- A. Tradescanti** L. Michaelmas Daisy.
Wauwatosa and Whitefish Bay. Occasional.
- A. ericoides** L. Frost-weed Aster.
Cement Works on Milwaukee River. Sec. 6, Greenfield.
- A. lateriflorus** (L.) Britton. Starved Aster.
Throughout county. Locally common.
- A. angustus** (Lindl.) T. & G. *Brachyactis angustus* (Lindl.) Britton.
Rayless Aster. In waste places in city. Spreading.
- Erigeron pulchellus** Michx. Poor Robin's Plantain.
Menomonee Valley.
- E. philadelphicus** L. Philadelphia Fleabane.
Throughout county. Common.
- E. annuus** (L.) Pers. Sweet Scabious.
Throughout county. Common.
- E. ramosus** (Walt.) B. S. P. Daisy Fleabane.
Throughout county. Common.
- E. canadensis** L. *Leptilon Canadense* (L.) Britton. Horse-weed.
Everywhere.
- Doellingeria umbellata** (Mill.) Nees. Tall Flat-top White Aster.
Menomonee Valley and Whitefish Bay. Locally abundant.
- Antennaria neodioica** Greene. Smaller Cat's-foot.
Throughout county. Common.
- A. neglecta** Greene. Field Cat's-foot.
Banks of Fish Creek, Town of Milwaukee.

- A. petaloides** Fernald.
Banks of Fish Creek, Town of Milwaukee.
- A. plantaginifolia** (L.) Richards. Plantain-leaf Everlasting.
Throughout county. Common.
- Anaphalis margaritacea** (L.) Benth & Hook.
Large-flowered Everlasting. New Coeln.
- Gnaphalium polycephalum** Michx. *G. obtusifolium* L.
Sweet Everlasting. Throughout county. Common.
- G. decurrens** Ives. Clammy Everlasting.
Near St. Francis Seminary.
- G. uliginosum** L. Low Cudweed.
Southern part of county.
- Inula Helenium** L. Elecampane.
Southern part of county, also Lake Woods. Locally abundant.
- Polymnia canadensis** L. Small-flowered Leaf-cup.
Wauwatosa.
- Silphium perfoliatum** L. Indian-cup.
Sec. 8, Greenfield, according to Bennetts.
- S. integrifolium** Michx. Entire-leaved Rosinweed.
Bay View and Sec. 20, Franklin. Locally common.
- S. laciniatum** L. Compass-plant.
Secs. 20, 32 and 33, Franklin. Occasional.
- S. terebinthinaceum** Jacq. Prairie Dock.
Bank of Milwaukee River and in Town of Franklin. Locally abundant.
- Heliopsis scabra** Dunal. Rough Ox-eye.
Throughout county. Common.
- Rudbeckia hirta** L. Black-eyed Susan.
Throughout county. Common.
- R. laciniata** L. Green-headed Cone-flower.
Throughout county. Locally abundant.
- Lepachys pinnata** (Vent.) T. & G. *Ratibida pinnata* (Vent.) Barnhardt. Gray-headed Cone-flower.
Menomonee Valley, Wauwatosa. Abundant.
- L. columnaris** (Sims.) T. & G. *Ratibida columnaris* (Sims.) D. Don.
Prairie Cone-flower. Menomonee Valley, Wauwatosa and Whitefish Bay. Locally abundant.

- Helianthus annuus** L. Common Sun-flower.
Escaped from cultivation. Occasional.
- H. petiolaris** Nutt. Prairie Sun-flower.
Menomonee Valley. Common.
- H. scaberrimus** Ell. Stiff Sunflower.
"Near C. & N. W. R. R. tracks, foot of Florida Str." Bennetts.
- H. giganteus** L. Giant Sunflower.
Menomonee Valley and Whitefish Bay. Occasional.
- H. Maximiliani** Schrad. Maximilian's Sunflower.
North Greenfield.
- H. divaricatus** L. Rough or Woodland Sunflower.
Southern and western parts of county. Common.
- H. mollis** Lam. Hairy Sunflower.
Menomonee Valley, near foot of 17th Str.
- H. doronicoides** Lam. Oblong-leaved Sunflower.
Reported by Mr. Runge.
- H. decapetalus** L. Thin-leaved Sunflower.
Throughout county. Common.
- H. strumosus** L. Pale-leaved Wood Sunflower.
In southern and western parts of county. Occasional.
- H. tuberosus** L. Jerusalem Artichoke. In Menomonee Valley and
along Milwaukee River. Not uncommon.
- Coreopsis palmata** Nutt. Stiff Tickseed.
Wauwatosa.
- C. lanceolata** L. Lance-leaved Tickseed. Reported by C. E. Brown
from S. E. $\frac{1}{4}$, Sec. 19, Town of Milwaukee.
- Bidens chrysanthemoides** Michx. *B. laevis* (L.) B. S. P.
Smooth Bur Marigold. Throughout county. Occasional.
- B. cernua** L. Nodding Bur Marigold.
Throughout county. Occasional.
- B. connata** Muhl. Purple-stemmed Beggar-ticks.
Reported by T. Bruhin from near New Coeln.
- B. frondosa** L. Black Beggar-ticks.
Everywhere. Common.
- B. vulgata** Greene. Tall Beggar-ticks.
Throughout county. Common.

- B. trichosperma** (Mich.) Britton. Tall Tickseed Sunflower.
Sec. 1, Greenfield.
- B. aristosa** (Michx.) Britton. Western Tickseed Sunflower.
Locally common.
- Galinsoga parviflora** var. **hispida** DC. Galinsoga.
Throughout city. Locally abundant. Spreading.
- Helenium autumnale** L. Swamp Sunflower. Sneezeweed.
Throughout county. Common.
- Achillea Millefolium** L. Yarrow. Milfoil.
Everywhere. Common.
- Anthemis Cotula** L. Mayweed.
Everywhere. Common.
- A. arvensis** L. Field Camomile.
"Along Lincoln Ave. west of Forest Home Cemetery." Bennetts.
- Chrysanthemum Leucanthemum** L. Ox-eye Daisy.
Throughout county. Locally abundant.
- C. Balsamita** L. Costmary.
Escaped from gardens. Occasional.
- Matricaria inodora** L. Scentless Camomile.
"Forest Home Ave. opposite Pilgrims Rest Cemetery." Bennetts.
- M. Chamomilla** L. Wild Camomile.
Along streets of city.
- Tanacetum vulgare** L. Tansy. Menomonee Valley, Fond du Lac road,
Mineral Spring road and elsewhere. Locally copious.
- Artemisia caudata** Michx. Tall Wormwood.
Waste places in city, also on lake shore.
- A. canadensis** Michx. Canada Wormwood.
Along lake shore, south of city.
- A. Absinthium** L. Common Wormwood or Absinth.
Escaped from cultivation. Occasional.
- A. biennis** Willd. Biennial Wormwood.
Waste places in city. Common.
- A. vulgaris** L. Common Mugwort.
Throughout county. Common.

- A. Pontica** L. Roman Wormwood.
Escaped from gardens. Rare.
- A. ludoviciana** Nutt. Lobed Cudweed. Menomonee Valley and waste places in city, also recorded as *A. gnaphalodes* Nutt.
- Erechtites hieracifolia** (L.) Raf. Fireweed.
Whitefish Bay.
- Cacalia reniformis** Muhl. *Mesadenia reniformis* (Muhl.) Raf.
Great Indian Plantain. Menomonee Valley. Common.
- C. atriplicifolia** L. *Mesadenia atriplicifolia* (L.) Raf.
Pale Indian Plantain. Throughout county. Occasional.
- C. suaveolens** L. *Synosma suaveolens* (L.) Raf.
Sweet-scented Indian Plantain.
Milwaukee River near city and near Whitefish Bay.
- Senecio Balsamitæ** Muhl. Balsam Groundsel.
"West of National Home." Occasional.
- S. aureus** L. Golden Ragwort.
Menomonee Valley and southern part of county.
- S. palustris** (L.) Hook. Marsh Fleawort.
Throughout county. Occasional.
- S. vulgaris** L. Common Groundsel.
In southern part of county. Common.
- Arctium Lappa** L. Great Burdock.
Everywhere.
- Cirsium lanceolatum** (L.) Scop. *Carduus lanceolatus* L.
Common Thistle. Everywhere.
- C. altissimum** (L.) Spreng. *Carduus altissimus* L. Tall Thistle.
Menomonee Valley and Whitefish Bay. Not uncommon.
- C. discolor** Spreng. *Carduus discolor* (Muhl.) Nutt. Field Thistle.
Throughout county. Common.
- C. muticus** Michx. *Carduus muticus* (Michx.) Pers. Swamp Thistle.
"A mile east of New Coeln." (T. Bruhin.)
- C. arvensis** (L.) Scop. *Carduus arvensis* (L.) Robs. Canada Thistle.
Everywhere.
- Centaurea Cyanus** L. Blue-bottle.
In southern and western parts of county.

INDEX TO FAMILIES.

	PAGE		PAGE
ACERACEÆ	209	ERICACEÆ	215
AIZOACEÆ	192	EUPHORBIACEÆ	207
ALISMACEÆ	171	FAGACEÆ	187
AMARANTHACEÆ	191	GENTIANACEÆ	216
AMARYLLIDACEÆ	182	GERANIACEÆ	206
AMBROSIACEÆ	229	GRAMINEÆ	172
ANACARDIACEÆ	208	GROSSULARIACEÆ	200
APOCYNACEÆ	217	HALORAGIDACEÆ	213
AQUIFOLIACEÆ	208	HAMAMELIDACEÆ	200
ARACEÆ	179	HIPPOCASTANACEÆ	209
ARALIACEÆ	213	HYDROCHARITACEÆ	172
ARISTOLOCHIACEÆ	189	HYDROPHYLLACEÆ	218
ASCLEPIADACEÆ	217	HYPERICACEÆ	210
BALSAMINACEÆ	209	ILICACEÆ	208
BERBERIDACEÆ	196	IRIDACEÆ	182
BETULACEÆ	186	JUGLANDACEÆ	186
BORAGINACEÆ	218	JUNCACEÆ	180
CAESALPINIACEÆ	204	JUNCAGINACEÆ	171
CALLITRICHACEÆ	208	LABIATÆ	219
CAMPANULACEÆ	227	LEGUMINOSÆ	204
CAPPARIDACEÆ	199	LEMNACEÆ	179
CAPRIFOLIACEÆ	225	LENTIBULACEÆ	223
CARYOPHYLLACEÆ	192	LILIACEÆ	180
CELASTRACEÆ	208	LILIACEÆ	180
CERATOPHYLLACEÆ	193	LIMNANTHACEÆ	208
CHENOPODIACEÆ	190	LINACEÆ	206
CICHORIACEÆ	227	LOBELIACEÆ	227
COMMELINACEÆ	179	LYCOPODIACEÆ	170
COMPOSITÆ	227	LYTHRACEÆ	211
COMPOSITÆ	229	MAGNOLIACEÆ	193
CONVALLARIACEÆ	180	MALVACEÆ	210
CONVOLVULACEÆ	217	MELANTHACEÆ	180
CORNACEÆ	214	MENISPERMACÆÆ	196
CRASSULACEÆ	199	MENYANTHACEÆ	217
CRUCIFERÆ	197	MONOTROPACEÆ	215
CUCURBITACEÆ	226	MORACEÆ	188
CUSCUTACEÆ	218	NAIADACEÆ	171
CYPERACEÆ	176	NYCTAGINACEÆ	191
DIOSCOREACEÆ	182	NYMPHAEACEÆ	193
DROSERACEÆ	199	OLEACEÆ	216
DRUPACEÆ	203	ONAGRACEÆ	212
ELAEAGNACEÆ	211	OPHIOGLOSSACEÆ	168
EQUISETACEÆ	170	ORCHIDACEÆ	183

	PAGE		PAGE
OROBANCHACEÆ	224	SALICACEÆ	184
OSMUNDACEÆ	168	SANTALACEÆ	188
OXALIDACEÆ	206	SAPINDACEÆ	209
PAPAVERACEÆ	196	SARRACENIACEÆ	199
PAPILIONACEÆ	204	SAXIFRAGACEÆ	199
PARNASSIACEÆ	199	SCHÆUCHTZERIACEÆ	171
PENTHORACEÆ	199	SCROPHULARIACEÆ	223
PHYRMACEÆ	224	SIMARUBACEÆ	207
PINACEÆ	170	SMILACEÆ	183
PLANTAGINACEÆ	224	SOLANACEÆ	221
PLATANACEÆ	200	SPARGANIACEÆ	171
POLEMONIACEÆ	218	THYMELEACEÆ	211
POLYGALACEÆ	207	TILIACEÆ	210
POLYGONACEÆ	189	TYPHACEÆ	171
POLYPODIACEÆ	169	ULMACEÆ	188
POMACEÆ	202	UMBELLIFERAE	213
PONTEDERIACEÆ	180	URTICACEÆ	188
PORTULACACEÆ	192	URTICACEÆ	188
PRIMULACEÆ	216	VACCINIACEÆ	215
PYROLACEÆ	215	VALERIANACEÆ	226
RANUNCULACEÆ	193	VALLISNERIACEÆ	173
RHAMNACEÆ	209	VERBENACEÆ	219
ROSACEÆ	200	VIOLACEÆ	211
RUBIACEÆ	224	VITACEÆ	210
RUTACEÆ	206		

INDEX TO GENERA AND SPECIES.

	PAGE		PAGE
abortivus (<i>Ranunculus</i>)	195	Ambrosia	229
Absinthium (<i>Artemisia</i>)	235	Amelanchier	202
Abutilon	210	americana (<i>Campanula</i>)	227
Acalypha	207	americana (<i>Conopholis</i>)	224
<i>acanthioides</i> (<i>Gertneria</i>)	229	americana (<i>Corylus</i>)	186
acaulis (<i>Cypripedium</i>)	183	Americana (<i>Fagus</i>)	187
Acer	209	americana (<i>Fraxinus</i>)	216
acerifolium (<i>Viburnum</i>)	225	americana (<i>Linnæa</i>)	226
Acetosella (<i>Rumex</i>)	189	Americana (<i>Panicularia</i>)	175
Achillea	235	americana (<i>Prunus</i>)	203
acicularis (<i>Eleocharis</i>)	176	americana (<i>Pyrola</i>)	215
acicularis (<i>Rosa</i>)	202	americana (<i>Tilia</i>)	210
Acnida	191	americana (<i>Trientalis</i>)	216
Acorus	179	americana (<i>Ulmus</i>)	188
acre (<i>Polygonum</i>)	190	americana (<i>Veronica</i>)	223
acris (<i>Ranunculus</i>)	195	americana (<i>Vicia</i>)	205
Acroanthus	184	americanum (<i>Erythronium</i>)	181
Actæa	194	americanum (<i>Xanthoxylum</i>)	206
acuminatum (<i>Asarum</i>)	189	americanum (<i>Ceanothus</i>)	209
acuminata (<i>Eleocharis</i>)	176	Americanus (<i>Lycopus</i>)	221
acuta (<i>Hepatica</i>)	194	Americanus (<i>Pyrus</i>)	202
acutifolia (<i>Hepatica</i>)	194	Americanus (<i>Scirpus</i>)	176
Adiantum	169	Ammophila	174
Adicea	188	Amomum (<i>Cornus</i>)	214
<i>Adopogon</i>	227	Amorpha	205
advena (<i>Nuphar</i>)	193	Ampelopsis	210
Æsculus	209	amphibium (<i>Polygonum</i>)	189
æstivalis (<i>Vitis</i>)	210	Amphicarpa	206
affinis (<i>Viola</i>)	211	amplexicaule (<i>Lamium</i>)	220
Agastache	220	amplifolius (<i>Potamogeton</i>)	171
ageratoides (<i>Eupatorium</i>)	229	amygdaloides (<i>Salix</i>)	185
agrarium (<i>Trifolium</i>)	204	Anagallis	216
Agrimonia	202	Anagallis—aquatica (<i>Veronica</i>)	223
Agropyron	175	Anaphalis	233
Agrostemma	192	andinum (<i>Lilium</i>)	181
Agrostis	173	Andrewsii (<i>Gentiana</i>)	217
Allanthus	207	Andropogon	172
alatum (<i>Lythrum</i>)	211	androsæmifolium (<i>Apocynum</i>)	217
alba (<i>Actæa</i>)	194	Anemone	194
alba (<i>Agrostis</i>)	173	Anemonella	194
alba (<i>Betula</i>)	187	Angelica	214
alba (<i>Lychnis</i>)	192	angustifolia (<i>Vicia</i>)	205
alba (<i>Meililotus</i>)	204	angustifolium (<i>Epilobium</i>)	212
alba (<i>Populus</i>)	184	angustifolium (<i>Sisyrinchium</i>)	182
alba (<i>Prenanthes</i>)	228	angustus (<i>Aster</i>)	232
alba (<i>Quercus</i>)	187	annua (<i>Poa</i>)	174
alba (<i>Salix</i>)	185	annuus (<i>Erigeron</i>)	232
albidum (<i>Erythronium</i>)	181	annuus (<i>Helianthus</i>)	234
album (<i>Chenopodium</i>)	190	Anogra	212
Alisma	171	Anserina (<i>Potentilla</i>)	201
<i>Alisma</i>	191	Antennaria	232
Allium	180	Anthemis	235
alnifolia (<i>Rhamnus</i>)	209	antirrhina (<i>Silene</i>)	192
<i>Alnobetula</i> (<i>Alnus</i>)	187	Aparine (<i>Gallium</i>)	224
Alnus	187	aparinoides (<i>Campanula</i>)	227
Alopecurus	173	apetalum (<i>Lepidium</i>)	197
alpina (<i>Circea</i>)	212	Aplos	206
alpinum (<i>Epilobium</i>)	212	Aplectrum	184
alpinus (<i>Juncus</i>)	180	Apocynum	217
<i>Aleine</i>	192	aquatica (<i>Zizania</i>)	172
alternifolia (<i>Cornus</i>)	192	aquaticum (<i>Eryngium</i>)	213
altissimum (<i>Cirsium</i>)	236	aquatilis (<i>Ranunculus</i>)	195
altissimum (<i>Sisymbrium</i>)	197	Aquilegia	194
altissimus (<i>Carduus</i>)	236	aquillina (<i>Pteris</i>)	169
Amaranthus	191	Arabis	198

	PAGE		PAGE
<i>Aralia</i>	213	<i>Berberis</i>	196
<i>arbutifolia</i> (Pyrus)	202	<i>Berteroa</i>	198
<i>Arctium</i>	236	<i>Betula</i>	187
<i>Arctostaphylos</i>	215	<i>Bidens</i>	234
<i>Arenaria</i>	193	<i>bicolor</i> (Quercus)	187
<i>arenaria</i> (Ammophila)	174	<i>Blouculla</i>	196
<i>arenarius</i> (Elymus)	175	<i>biennis</i> (Artemisia)	235
<i>arenicola</i> (Cardamine)	198	<i>biennis</i> (Gaura)	212
<i>Argemone</i>	196	<i>biennis</i> (Eriogonum)	212
<i>argentea</i> (Potentilla)	201	<i>biflora</i> (Impatiens)	209
<i>Argentina</i>	201	<i>biflorum</i> (Polygonatum)	181
<i>arguta</i> (Potentilla)	201	<i>biflorum</i> (Isopyrum)	194
<i>arguta</i> (Solidago)	230	<i>blanda</i> (Viola)	211
<i>Arisaema</i>	179	<i>Blattaria</i> (Verbascum)	222
<i>aristosa</i> (Bidens)	235	<i>blephariglossis</i>	183
<i>Armeria</i> (Silene)	192	<i>Blephilla</i>	220
<i>Armoracia</i> (Roripa)	197	<i>blitoides</i> (Amaranthus)	191
<i>Artemisia</i>	235	<i>Blitum</i>	191
<i>artemisiifolia</i> (Ambrosia)	229	<i>Boehmeria</i>	188
<i>arundinacea</i> (Phalaris)	173	<i>Boltonia</i>	231
<i>arundinaceum</i> (Dulichum)	176	<i>boreale</i> (Galium)	226
<i>arvense</i> (Trifolium)	204	<i>borealis</i> (Clintonia)	181
<i>arvense</i> (Cirsium)	236	<i>borealis</i> (Linnaea)	226
<i>arvense</i> (Equisetum)	170	<i>Bosclanum</i> (Chenopodium)	190
<i>arvense</i> (Thlaspi)	197	<i>Botrychium</i> (Amelanchier)	202
<i>arvensis</i> (Anagallis)	216	<i>Botrychium</i>	169
<i>arvensis</i> (Anthemis)	235	<i>Botrys</i> (Chenopodium)	191
<i>arvensis</i> (Brassica)	197	<i>Brachyactis</i>	233
<i>arvensis</i> (Carduus)	236	<i>brachycarpa</i> (Arabis)	198
<i>arvensis</i> (Convolvulus)	218	<i>Brachyelytrum</i>	173
<i>arvensis</i> (Mentha)	221	<i>bracteata</i> (Diplotaxis)	197
<i>arvensis</i> (Sonchus)	228	<i>bracteata</i> (Habenaria)	183
<i>arvensis</i> (Veronica)	223	<i>bracteosa</i> (Verbena)	219
<i>asarifolia</i> (Pyrola)	215	<i>Brassica</i>	197
<i>Asarum</i>	189	<i>bromoides</i> (Carex)	179
<i>Asclepias</i>	217	<i>Bromus</i>	175
<i>Ascyron</i> (Hypericum)	210	<i>bufonius</i> (Juncus)	180
<i>Asparagus</i>	181	<i>bulbifera</i> (Cicuta)	214
<i>asper</i> (Sonchus)	228	<i>bulbifera</i> (Cystopteris)	169
<i>aspera</i> (Stachys)	220	<i>bulbosa</i> (Cardamine)	198
<i>asperifolia</i> (Oryzopsis)	173	<i>bulbosa</i> (Erigenia)	213
<i>Aspidium</i>	169	<i>bulbosus</i> (Ranunculus)	195
<i>Asplenium</i>	169	<i>Bursa</i>	198
<i>asprellum</i> (Galium)	225	<i>Bursa-pastoris</i> (Capsella)	198
<i>Aster</i>	231	<i>byzantina</i> (Veronica)	223
<i>asteroides</i> (Boltonia)	231		
<i>Astragalus</i>	205	<i>Cacalia</i>	236
<i>Atriplex</i>	191	<i>caesia</i> (Solidago)	230
<i>atriplicifolia</i> (Cacalia)	236	<i>Cakile</i>	197
<i>atropurpurea</i> (Angelica)	214	<i>Calamagrostis</i>	173
<i>atropurpureum</i> (Thaspium)	214	<i>Calamus</i> (Acorus)	179
<i>atropurpureus</i> (Euonymus)	208	<i>calcedonica</i> (Lychnis)	192
<i>atrovirens</i> (Scripus)	176	<i>Calla</i>	179
<i>aurea</i> (Carex)	178	<i>Callitriche</i>	208
<i>aurea</i> (Corydalis)	196	<i>Calopogon</i>	183
<i>aureum</i> (Thaspium)	214	<i>Caltha</i>	193
<i>aureus</i> (Senecio)	236	<i>Camelina</i>	198
<i>autumnale</i> (Helenium)	235	<i>Campanula</i>	227
<i>Avena</i>	174	<i>campestris</i> (Brassica)	197
<i>avicularis</i> (Polygonum)	190	<i>campestris</i> (Luzula)	180
<i>azureum</i> (Delphinium)	194	<i>Campylosorus</i>	169
<i>azureus</i> (Aster)	231	<i>canadense</i> (Allium)	181
		<i>canadense</i> (Asarum)	189
<i>babylonica</i> (Salix)	185	<i>canadense</i> (Desmodium)	225
<i>Baleyanus</i> (Rubus)	201	<i>canadense</i> (Geum)	201
<i>balsamifera</i> (Populus)	184	<i>canadense</i> (Hieracium)	228
<i>Balsamita</i> (Chrysanthemum)	235	<i>canadense</i> (Hypericum)	210
<i>Balsamita</i> (Senecio)	236	<i>canadense</i> (Lilium)	181
<i>Baptisia</i>	204	<i>canadense</i> (Majanthemum)	181
<i>Batrachium</i>	195	<i>canadense</i> (Menispermum)	196
<i>Bebbiana</i> (Salix)	185	<i>canadense</i> (Teucrium)	219

	PAGE		PAGE
canadensis (Amelanchier)	202	Centaurea	226
canadensis (Anemone)	194	cephalantha (Carex)	178
canadensis (Aquillegia)	194	Cephalanthus	224
canadensis (Arabis)	198	cephalophora (Carex)	178
canadensis (Artemisia)	235	Cerastium	193
canadensis (Astragalus)	205	Ceratophyllum	193
canadensis (Calamagrostis)	173	cernua (Bidens)	234
canadensis (Cornus)	214	cernua (Spiranthes)	184
canadensis (Cryptotaenia)	214	cernuum (Allium)	180
canadensis (Dioentra)	196	cernuum (Trillium)	182
canadensis (Eloidea)	172	<i>Chaetochloa</i>	172
canadensis (Elymus)	175	Chamaecrista (Cassia)	204
canadensis (Erigeron)	232	<i>Chamaenerion</i>	212
canadensis (Hydrastis)	193	Chamomilla (Matricaria)	235
canadensis (Lactuca)	228	Chelone	222
canadensis (Laportea)	188	cheiranthoides (Erysimum)	198
canadensis (Loncera)	226	Chenopodium	190
canadensis (Mentha)	221	chinense (Conioselinum)	214
canadensis (Pedicularis)	223	chrysanthemoides (Bidens)	234
canadensis (Polymnia)	233	Chrysanthemum	235
canadensis (Potentilla)	201	Cichorium	227
canadensis (Rubus)	201	Cicuta	213
canadensis (Sambucus)	225	cicutefolium (Stium)	214
canadensis (Sanguinaria)	196	ciliata (Blephilla)	220
canadensis (Sanicula)	213	ciliata (Loncera)	226
canadensis (Shepherdia)	211	ciliatum (Steironema)	216
canadensis (Solidago)	230	ciliatum (Bromus)	175
cananariensis (Phalaris)	173	cillinode (Polygonum)	190
candicans (Populus)	184	cinerea (Juglans)	186
candida (Salix)	186	cinnamomea (Osmunda)	169
<i>candidissima</i> (Cornus)	215	Circea	212
canescens (Amorpha)	205	circaeans (Gallium)	225
canescens (Lithospermum)	219	circinata (Cornus)	214
cannabina (Apocynum)	217	Cirsium	236
Cannabis	188	Cladium	177
capillaceus (Ranunculus)	195	clavatum (Lycopodium)	170
capillare (Panicum)	172	Claytoni (Osmorhiza)	213
capillaris (Eragrostis)	174	Claytonia	192
capitata (Lespedeza)	205	Claytoniana (Osmunda)	169
capitata (Chenopodium)	191	Clematis	194
<i>Capnoides</i>	196	Cleome	199
Cardamine	197	Clintonia	181
Cardiaca (Leonurus)	220	coccinea (Castilleja)	223
cardinalis (Lobelia)	227	coccinea (Crataegus)	203
<i>Carduus</i>	236	coccinea (Quercus)	187
Carex	177	<i>Caloglossum</i>	183
Careyi (Polygonum)	189	coloratum (Epilobium)	212
carolina (Rosa)	202	columnaris (Lepachys)	233
carolinense (Solanum)	221	Comandra	188
caroliniana (Carpinus)	186	<i>Comarum</i>	201
caroliniana (Parnassia)	199	communis (Juniperus)	170
caroliniana (Vicia)	205	communis (Lapsana)	227
<i>Carolinianum</i> (Delphinium)	194	communis (Ricinus)	207
carolinianum (Geranium)	206	commutatum (Polygonatum)	181
carolinianum (Onosmodium)	219	comosa (Amphicarpa)	206
Carpinus	186	compressa (Poa)	174
Carul (Carum)	214	conclinnum (Gallium)	225
Carum	214	conglomeratum (Rumex)	189
Carya	186	Conioselinum	214
Cassia	204	conjuncta (Crataegus)	203
cassinoides (Viburnum)	225	connata (Bidens)	234
<i>Castalia</i>	193	conoidea (Carex)	177
Castilleja	223	Conopholis	224
Cataria (Nepeta)	220	Conringia	198
cathartica (Rhamnus)	209	Consolida (Delphinium)	194
caudata (Artemisia)	235	conspersa (Viola)	211
Caulophyllum	196	Convolvulus	218
Ceanothus	209	Convolvulus (Polygonum)	190
Celastrus	208	Coptis	193
Celtis	188	Corallorrhiza	184
Cenchrus	172	cordata (Crataegus)	203

	PAGE		PAGE
cordata (Plantago)	224	dioica (Lonicera)	226
cordata (Salix)	185	dioica (Urtica)	188
cordifolia (Vitis)	210	dioicum (Thalictrum)	195
cordifolia (Scutellaria)	220	Dioscorea	182
cordifolius (Aster)	281	diphylla (Jeffersonia)	196
cordiformis (Carya)	186	diphylla (Mitella)	199
Coreopsis	234	Diplostaxis	197
Cornus	214	Dirca	211
corollata (Euphorbia)	207	discolor (Cirsium)	236
coronaria (Pyrus)	202	discolor (Salix)	185
Corydalis	196	dissecta (Cyclanthera)	226
Corylus	186	divaricata (Phlox)	218
corymbosum (Vaccinium)	215	divaricatum (Urticastrum)	188
Cotula (Anthemis)	235	divaricatus (Aster)	231
Cracca (Vicia)	205	divaricatus (Helianthus)	234
Crataegus	202	diversifolius (Potamogeton)	171
crinita (Gentiana)	216	Dodecatheon	216
crispus (Rumex)	189	Doellingeria	232
cristatum (Aspidium)	169	dolorosa (Salix)	185
Croton	207	doronicoides (Helianthus)	234
cruciata (Eriogonum)	212	Drosera	199
crus-galli (Echinocloa)	172	Drummondii (Aster)	231
cryptandrus (Sporobolus)	173	Dryopteris	169
Cryptogramma	169	dubia (Heteranthera)	180
Cryptotaenia	214	dubium (Trifolium)	204
Cucullaria (Dicentra)	196	Dulcamara (Solanum)	222
cucullata (Viola)	211	Dulichium	176
cuspidata (Viola)	211	dumetorum (Polygonum)	190
Cuscuta	218	duriuscula (Festuca)	175
cyanophylla (Crataegus)	203	Echinocloa	172
Cyanus (Centaurea)	236	Echinocystis	226
Cyclanthera	226	Echium	189
cylindrica (Anemone)	194	ecirrhata (Smilax)	212
cylindrica (Boehmeria)	188	edentula (Cakile)	197
Cymbalaria	222	edulis (Valeriana)	226
Cymbalaria (Linaria)	222	effusum (Miliium)	173
Cynoglossum	218	effusus (Juncus)	180
Cynosbati (Ribes)	200	Eleocharis	176
cynosuroides (Spartina)	174	ellipsoidal (Quercus)	187
Cyparissias (Euphorbia)	207	elliptica (Pyrola)	215
cyperinus (Scirpus)	176	Elodea	172
Cyperus	176	Elymus	175
Cypripedium	183	emersum (Polygonum)	189
Cystopteris	169	Engelmanni (Cyperus)	176
Dactylis	174	Epilobium	213
Danthonia	174	Epiphegus	224
Dasiphora	201	Equisetum	170
Dasystoma	223	Eragrostis	174
Datura	222	Erechtites	236
debilis (Poa)	174	erectum (Brachyelytrum)	173
decapetalus (Helianthus)	234	erectum (Polygonum)	190
decurrens (Gnaphallum)	233	erectum (Trillium)	182
delphinifolius (Ranunculus)	195	ericoides (Aster)	232
Delphinium	194	Erigenia	213
deltoides (Populus)	184	Erigeron	232
demersum (Ceratophyllum)	193	Eriophorum	176
Dentaria	198	Eriophorum (Scirpus)	176
dentatum (Viburnum)	225	Eryngium	213
depressa (Juniperus)	170	Erysimum	198
Deringa...	214	Erythronium	181
Desmodium	205	esculentum (Fagopyrum)	189
Deweyana (Carex)	179	esculentus (Cyperus)	176
diandrus (Cyperus)	176	Euonymus	208
Dicentra	196	Eupatorium	229
dichotomum (Panicum)	172	Euphorbia	207
Diervilla	226	europeus (Lycopus)	221
Diervilla (Diervilla)	226	eurycarpum (Sparganium)	171
Digitalis (Pentstemon)	222	Euthamia	231
Digitaria	172	exaltata (Asclepias)	217
dilatata (Habenaria)	183		

	PAGE		PAGE
<i>Fagopyrum</i>	189	<i>Gleditsia</i>	204
<i>Fagus</i>	187	<i>glomerata</i> (Rhyncospora)	177
<i>Falcata</i>	206	<i>glomerata</i> (Dactylis)	174
<i>falcata</i> (Salix)	185	<i>glutinosa</i> (Tofieldia)	180
<i>fascicularis</i> (Ranunculus)	195	<i>Glyceria</i>	175
<i>fasciculata</i> (Vernonia)	229	<i>glyptosperma</i> (Euphorbia)	207
<i>Festuca</i>	175	<i>Gmelini</i> (Lithospermum)	219
<i>filiformis</i> (Carex)	177	<i>Gnaphalium</i>	233
<i>Filix</i>	169	<i>Goodyera</i>	184
<i>Filix-femina</i> (Asplenium)	169	<i>gracile</i> (Eriophorum)	177
<i>fistulosa</i> (Monarda)	220	<i>gracile</i> (Ribes)	200
<i>flabellata</i> (Crataegus)	202	<i>gracilis</i> (Urtica)	188
<i>flava</i> (Lonicera)	226	<i>gracillima</i> (Carex)	177
<i>flavescens</i> (Cyperus)	176	<i>gracizans</i> (Amaranthus)	191
<i>flavida</i> (Gentiana)	217	<i>gramineum</i> (Sisyrinchium)	182
<i>flexicaulis</i> (Solidago)	230	<i>graminifolia</i> (Solidago)	231
<i>Floerkea</i>	208	<i>grandidentata</i> (Populus)	184
<i>floribundus</i> (Samolus)	216	<i>grandiflora</i> (Gerardia)	223
<i>floridana</i> (Lactuca)	228	<i>grandiflora</i> (Uvularia)	180
<i>floridum</i> (Ribes)	200	<i>grandiflorum</i> (Desmodium)	205
<i>fluitans</i> (Panicularia)	175	<i>grandiflorum</i> (Trillium)	182
<i>fluviatile</i> (Equisetum)	170	<i>grandifolia</i> (Fagus)	187
<i>fluviatilis</i> (Salix)	185	<i>grandis</i> (Glyceria)	175
<i>foetida</i> (Symplocarpa)	179	<i>granularis</i> (Carex)	177
<i>foliosus</i> (Potamogeton)	171	<i>graveolens</i> (Polanisia)	199
<i>fontanum</i> (Epilobium)	212	<i>gregaria</i> (Sanicula)	213
<i>Fragaria</i>	201	<i>Grindelia</i>	229
<i>fragilis</i> (Cystopteris)	169	<i>Gronovii</i> (Cuscuta)	218
<i>fragilis</i> (Salix)	185	<i>gryposepala</i> (Agrimonia)	202
<i>Franseria</i>	229	<i>Gyrostachys</i>	184
<i>Fraxinus</i>	216	<i>Habenaria</i>	183
<i>frondosa</i> (Bidens)	234	<i>hallimifolium</i> (Lycium)	222
<i>fruticosa</i> (Potentilla)	201	<i>Hamamelis</i>	200
<i>fulva</i> (Ulmus)	188	<i>Hartwrightii</i> (Polygonum)	189
<i>Fumaria</i>	196	<i>hastata</i> (Atriplex)	191
<i>furcatus</i> (Andropogon)	172	<i>hastata</i> (Verbena)	219
<i>Gartneria</i>	229	<i>Hedeoma</i>	221
<i>Galeopsis</i>	220	<i>hederacea</i> (Glechoma)	220
<i>Galeorhiza</i>	183	<i>hederacea</i> (Ipomoea)	217
<i>galericulata</i> (Scutellaria)	220	<i>Helenium</i>	235
<i>Gallinsoga</i>	235	<i>Helenium</i> (Inula)	233
<i>Galium</i>	224	<i>Hellanthus</i>	234
<i>Gaultheria</i>	215	<i>Heliopsis</i>	233
<i>Gaura</i>	212	<i>Heliocopia</i> (Euphorbia)	207
<i>Gaylussacia</i>	215	<i>Hepatica</i>	194
<i>geniculatus</i> (Alopecurus)	173	<i>Heraclceum</i>	214
<i>Genista</i>	204	<i>herbacea</i> (Smilax)	182
<i>Gentiana</i>	216	<i>Hesperis</i>	198
<i>Geranium</i>	206	<i>Heteranthera</i>	180
<i>Gerardia</i>	223	<i>heterophylla</i> (Physalis)	221
<i>Geum</i>	201	<i>Heuchera</i>	199
<i>giganteus</i> (Hellanthus)	234	<i>Hibiscus</i>	210
<i>Githago</i> (Agrostemma)	192	<i>Hicoria</i>	186
<i>glabra</i> (Æsculus)	209	<i>hieracifolia</i> (Erechtites)	236
<i>glabra</i> (Arabis)	198	<i>Hieracium</i>	228
<i>glabra</i> (Carya)	186	<i>Hierochloa</i>	173
<i>glabra</i> (Chelone)	222	<i>Hippocastanum</i> (Æsculus)	209
<i>glabra</i> (Rhus)	208	<i>hirsuta</i> (Agrimonia)	202
<i>glabra</i> (Stachys)	220	<i>hirsuta</i> (Elephilla)	220
<i>glabratum</i> (Xanthium)	229	<i>hirsuta</i> (Cardamine)	198
<i>glandulosa</i> (Allanthus)	207	<i>hirsuta</i> (Hypoxis)	182
<i>glandulosa</i> (Betula)	187	<i>hirsuta</i> (Lactuca)	228
<i>glauca</i> (Poa)	174	<i>hirsutissima</i> (Pulsatilla)	194
<i>glauca</i> (Setaria)	172	<i>hirsutum</i> (Cypripedium)	183
<i>glaucescens</i> (Eleocharis)	176	<i>hirsutus</i> (Oxybaphus)	191
<i>glaucophylla</i> (Salix)	185	<i>hirsutus</i> (Pentstemon)	222
<i>glaucum</i> (Chenopodium)	190	<i>hirta</i> (Rudbeckia)	233
<i>Glechoma</i>	220	<i>hispida</i> (Galinsoga)	235
<i>Glechoma</i> (Nepeta)	220	<i>hispida</i> (Hedoma)	221

	PAGE		PAGE
<i>hispidula</i> (Heuchera)	199	<i>Kali</i> (Salsola)	191
<i>hispidula</i> (Smilax)	182	<i>Kalmii</i> (Bromus)	175
<i>hispidus</i> (Rubus)	201	<i>Kalmii</i> (Lobelia)	227
<i>Homalocenchrus</i>	173	<i>Kellia</i>	221
<i>Hookeri</i> (Habenaria)	183	<i>Krigia</i>	227
<i>Hookeriana</i> (Franseria)	229		
<i>Hookeriana</i> (Lysias)	183	<i>labradorica</i> (Viola)	211
<i>hordeaceus</i> (Bromus)	176	<i>ladera</i> (Habenaria)	183
<i>Hordeum</i>	176	<i>Lacinaria</i>	229
<i>horizontalis</i> (Juniperus)	170	<i>lacinolata</i> (Dentaria)	198
<i>Hornemannii</i> (Epilobium)	212	<i>lacinolata</i> (Rudbeckia)	233
<i>Houghtonii</i> (Carex)	177	<i>laciniatum</i> (Silphium)	223
<i>Houghtonii</i> (Solidago)	230	<i>Lactuca</i>	228
<i>humifusa</i> (Digitalis)	172	<i>lacustris</i> (Iris)	182
<i>humilis</i> (Rosa)	202	<i>lacustris</i> (Scirpus)	176
<i>Humulus</i>	188	<i>Ladanum</i> (Galeopsis)	220
<i>hybridum</i> (Chenopodium)	190	<i>laevigata</i> (Arabis)	198
<i>hybridum</i> (Trifolium)	204	<i>laevigata</i> (Ilex)	208
<i>hybridus</i> (Amaranthus)	191	<i>laevigatus</i> (Aster)	231
<i>Hydrastis</i>	193	<i>laevigatus</i> (Pentstemon)	222
<i>Hydrophyllum</i>	218	<i>laevis</i> (Aster)	233
<i>Hydropiper</i> (Polygonum)	190	<i>Lamium</i>	230
<i>hydropiperoides</i> (Polygonum)	190	<i>lanatum</i> (Heracleum)	214
<i>hyemale</i> (Equisetum)	170	<i>lanceolata</i> (Coreopsis)	234
<i>hyemalis</i> (Agrostis)	173	<i>lanceolata</i> (Fraxinus)	216
<i>Hyoscyamus</i>	222	<i>lanceolata</i> (Pedicularis)	223
<i>hyperborea</i> (Habenaria)	183	<i>lanceolata</i> (Plantago)	224
<i>hypericifolium</i> (Apocynum)	217	<i>lanceolata</i> (Viola)	211
<i>Hypericum</i>	210	<i>lanceolatum</i> (Cirsium)	236
<i>hypnoides</i> (Eragrostis)	174	<i>lanceolatum</i> (Pycnanthemum)	221
<i>Hypoxis</i>	182	<i>lanceolatus</i> (Carduus)	236
<i>hystrix</i> (Carex)	177	<i>lapathifolium</i> (Polygonum)	189
<i>Hystrix</i>	175	<i>Laportea</i>	188
		<i>Lappa</i> (Arctium)	236
<i>Ilex</i>	208	<i>Lappula</i>	218
<i>Impatiens</i>	209	<i>Lapsana</i>	227
<i>incana</i> (Berteroa)	198	<i>laricina</i> (Larix)	170
<i>incarnata</i> (Asclepias)	217	<i>Larix</i>	170
<i>incarnata</i> (Pyrola)	215	<i>lateriflora</i> (Arenaria)	193
<i>incarnatum</i> (Polygonum)	189	<i>lateriflora</i> (Scutellaria)	219
<i>incarnatum</i> (Trifolium)	204	<i>lateriflorus</i> (Aster)	232
<i>inflata</i> (Lobelia)	227	<i>Lathyrus</i>	205
<i>inodora</i> (Matricaria)	235	<i>latifolia</i> (Polygala)	207
<i>insignis</i> (Juncus)	180	<i>latifolia</i> (Sagittaria)	171
<i>integerrima</i> (Tænidia)	214	<i>latifolia</i> (Solidago)	230
<i>integrata</i> (Lactuca)	228	<i>latifolia</i> (Spiranthes)	184
<i>integrifolia</i> (Ambrosia)	229	<i>latifolia</i> (Typha)	171
<i>integrifolia</i> (Lactuca)	228	<i>latifolium</i> (Lithospermum)	219
<i>integrifolium</i> (Silphium)	233	<i>laurifolia</i> (Salix)	185
<i>interior</i> (Carex)	179	<i>laxicaulis</i> (Ranunculus)	195
<i>intermedium</i> (Aspidium)	169	<i>laxiflora</i> (Carex)	177
<i>intumescens</i> (Carex)	177	<i>Leersia</i>	172
<i>Intybus</i> (Cichorium)	227	<i>lelocarpum</i> (Sisymbrium)	197
<i>Inula</i>	233	<i>Lemna</i>	179
<i>Ipomoea</i>	217	<i>lenta</i> (Betula)	187
<i>Iris</i>	182	<i>Lentago</i> (Viburnum)	225
<i>Isardia</i>	212	<i>Leonurus</i>	223
<i>Isopyrum</i>	194	<i>Lepachys</i>	233
<i>Iva</i>	229	<i>Lepargyrea</i>	211
		<i>Lepidium</i>	197
<i>japonica</i> (Lonitcera)	226	<i>leptalea</i> (Carex)	178
<i>Jeffersonia</i>	196	<i>Leptamnium</i>	224
<i>jubatum</i> (Hordeum)	175	<i>Leptandra</i>	223
<i>Juglans</i>	186	<i>Leptilon</i>	232
<i>junceae</i> (Brassica)	197	<i>leptocaulis</i> (Aster)	231
<i>junceae</i> (Solidago)	230	<i>Leptostachya</i> (Phryma)	224
<i>juncus</i> (Aster)	232	<i>Lespedeza</i>	205
<i>Juncoides</i>	180	<i>leucantha</i> (Baptisia)	204
<i>Juncus</i>	180	<i>Leucanthemum</i> (Chrysanthemum)	235
<i>Juniperus</i>	170	<i>Lewisii</i> (Linum)	206

	PAGE		PAGE
<i>Liatris</i>	229	<i>maxima</i> (Dentaria)	198
<i>Lilium</i>	181	<i>Maximillani</i> (Helianthus)	234
<i>Limnorchis</i>	183	<i>Meadia</i> (Dodecatheon)	216
<i>Limodorum</i>	183	<i>media</i> (Habenaria)	183
<i>Linaria</i>	222	<i>media</i> (Stellaria)	192
<i>lineare</i> (Melampyrum)	223	<i>Medicago</i>	204
<i>linearis</i> (Syntherisma)	172	<i>Meibomia</i>	205
<i>linifolius</i> (Sericocarpus)	231	<i>Melampyrum</i>	223
<i>Linnæa</i>	226	<i>Melica</i>	174
<i>Linum</i>	206	<i>Melilotus</i>	204
<i>Liriodendron</i>	193	<i>Menispermum</i>	196
<i>Lithospermum</i>	219	<i>Mentha</i>	221
<i>lobata</i> (Echinocytis)	226	<i>Menyanthes</i>	217
<i>Lobelia</i>	227	<i>Mesadenia</i>	236
<i>Lolium</i>	175	<i>Metel</i> (Datura)	222
<i>longifolia</i> (Salix)	185	<i>mexicana</i> (Argemone)	196
<i>longifolia</i> (Stellaria)	193	<i>mexicana</i> (Muhlenbergia)	173
<i>longifolius</i> (Aster)	232	<i>Micranthemum</i>	226
<i>longipes</i> (Stellaria)	193	<i>micranthus</i> (Ranunculus)	195
<i>longistylis</i> (Osmorhiza)	213	<i>microcarpa</i> (Rhus)	208
<i>Lonicera</i>	226	<i>Millium</i>	173
<i>Lowricanus</i> (Aster)	231	<i>Millefolium</i> (Achillea)	235
<i>lucida</i> (Rosa)	202	<i>Mimulus</i>	222
<i>lucida</i> (Salix)	185	<i>minima</i> (Hicoria)	186
<i>lucidulum</i> (Lycopodium)	170	<i>minor</i> (Eragrostis)	174
<i>lucidulum</i> (Aster)	231	<i>minor</i> (Lemna)	179
<i>lucorum</i> (Cratægus)	203	<i>minor</i> (Quercus)	187
<i>ludoviciana</i> (Artemisia)	236	<i>Mitchella</i>	224
<i>ludoviciana</i> (Lactuca)	228	<i>Mitella</i>	199
<i>Ludwigia</i>	212	<i>Muhlenbergia</i>	193
<i>lupuliformis</i> (Carex)	177	<i>mollis</i> (Alnus)	187
<i>lupulina</i> (Carex)	177	<i>mollis</i> (Cratægus)	203
<i>lupulina</i> (Medicago)	204	<i>mollis</i> (Helianthus)	234
<i>Lupulus</i> (Humulus)	188	<i>Mollugo</i>	192
<i>lurida</i> (Carex)	177	<i>Monarda</i>	220
<i>lutea</i> (Betula)	187	<i>monille</i> (Carex)	177
<i>Lutetiana</i> (Circæa)	212	<i>monophylla</i> (Acroanthos)	184
<i>Luzula</i>	180	<i>Monotropa</i>	215
<i>Lychnis</i>	192	<i>monspeliensis</i> (Potentilla)	201
<i>Lycium</i>	222	<i>moschata</i> (Malva)	210
<i>Lycopodium</i>	170	<i>Muhlenbergia</i>	173
<i>Lycopus</i>	221	<i>Muhlenbergii</i> (Polygonum)	189
<i>Lysias</i>	183	<i>multiflora</i> (Corallorrhiza)	184
<i>Lysimachia</i>	216	<i>multiflora</i> (Luzula)	180
<i>Lythrum</i>	211	<i>muticum</i> (Cirsium)	236
<i>macracantha</i> (Cratægus)	203	<i>muticus</i> (Carduus)	236
<i>macrocarpa</i> (Quercus)	187	<i>Myosotis</i>	219
<i>macrocarpon</i> (Vaccinium)	215	<i>Myosotis</i> (Lappula)	218
<i>macrophyllum</i> (Geum)	201	<i>Myriophyllum</i>	213
<i>macrophyllus</i> (Aster)	231	<i>myrtilloides</i> (Salix)	185
<i>maculata</i> (Cicuta)	213	<i>Nabulus</i>	228
<i>maculata</i> (Euphorbia)	207	<i>nana</i> (Juniperus)	170
<i>maculatum</i> (Geranium)	206	<i>Nasturtium</i> (Roripa)	197
<i>maculatum</i> (Hypericum)	210	<i>natans</i> (Potamogeton)	171
<i>Majanthemum</i>	181	<i>Naumburgia</i>	216
<i>major</i> (Eragrostis)	174	<i>neglecta</i> (Antennaria)	232
<i>major</i> (Plantago)	224	<i>neglecta</i> (Solidago)	230
<i>Malva</i>	202	<i>neglectus</i> (Astragalus)	205
<i>Malva</i>	210	<i>Negundo</i> (Acer)	209
<i>margaritacea</i> (Anaphalis)	233	<i>nemorialis</i> (Solidago)	230
<i>marginata</i> (Euphorbia)	207	<i>neodiola</i> (Antennaria)	232
<i>marginatus</i> (Juncus)	180	<i>neottia</i> (Corallorrhiza)	184
<i>mariscoides</i> (Cladium)	177	<i>Nepeta</i>	220
<i>maritimum</i> (Polygonum)	190	<i>nervata</i> (Glyceria)	175
<i>maritimus</i> (Lathyrus)	205	<i>Nicotiana</i>	222
<i>marylandica</i> (Sanicula)	213	<i>niger</i> (Hyoscyamus)	222
<i>marylandica</i> (Scrophularia)	222	<i>nigra</i> (Brassica)	197
<i>Mateuccia</i>	170	<i>nigra</i> (Fraxinus)	216
<i>Matricaria</i>	235	<i>nigra</i> (Juglans)	186
<i>matronalis</i> (Hesperis)	198	<i>nigra</i> (Populus)	184

	PAGE		PAGE
<i>nigra</i> (<i>Salix</i>)	184	<i>Oxyccoccus</i>	215
<i>nigra</i> (<i>Vicia</i>)	205	<i>Oxypolis</i>	214
<i>nigrobaccus</i> (<i>Rubus</i>)	201		
<i>nigrum</i> (<i>Acer</i>)	209	<i>pallida</i> (<i>Impatiens</i>)	209
<i>nigrum</i> (<i>Solanum</i>)	221	<i>pallida</i> (<i>Oenothera</i>)	212
<i>nivale</i> (<i>Trillium</i>)	182	<i>palmata</i> (<i>Coreopsis</i>)	234
<i>noctiflora</i> (<i>Silene</i>)	192	<i>palustris</i> (<i>Calla</i>)	179
<i>nodosus</i> (<i>Juncus</i>)	180	<i>palustris</i> (<i>Caltha</i>)	193
<i>novæ-angliæ</i> (<i>Aster</i>)	231	<i>palustris</i> (<i>Dirca</i>)	211
<i>novæ-angliæ</i> (<i>Carex</i>)	178	<i>palustris</i> (<i>Eleocharis</i>)	176
<i>nuda</i> (<i>Mitella</i>)	195	<i>palustris</i> (<i>Lathyrus</i>)	206
<i>nudicaulis</i> (<i>Aralia</i>)	213	<i>palustris</i> (<i>Ludwigia</i>)	212
<i>Nuphar</i>	193	<i>palustris</i> (<i>Myosotis</i>)	219
<i>nutans</i> (<i>Festuca</i>)	175	<i>palustris</i> (<i>Potentilla</i>)	201
<i>Nuttallii</i> (<i>Polytenia</i>)	214	<i>palustris</i> (<i>Proserpinaca</i>)	213
<i>Nuttallii</i> (<i>Potamogeton</i>)	171	<i>palustris</i> (<i>Roripa</i>)	197
<i>nyctagineus</i> (<i>Oxybaphus</i>)	191	<i>palustris</i> (<i>Senecio</i>)	236
<i>Nymphaea</i>	193	<i>palustris</i> (<i>Triglochin</i>)	171
		<i>Panax</i>	213
<i>Oakesiana</i> (<i>Oenothera</i>)	212	<i>Panicum</i>	172
<i>oblongifolia</i> (<i>Lonicera</i>)	226	<i>Papaver</i>	196
<i>obtusiflora</i> (<i>Cuscuta</i>)	218	<i>papyrifera</i> (<i>Betula</i>)	187
<i>obtusifolius</i> (<i>Rumex</i>)	189	<i>Parietaria</i>	188
<i>obtusiusculus</i> (<i>Ranunculus</i>)	195	<i>Parnassia</i>	199
<i>occidentalis</i> (<i>Celtis</i>)	188	<i>Parthenocissus</i>	210
<i>occidentalis</i> (<i>Cephalanthus</i>)	224	<i>parviflora</i> (<i>Cardamine</i>)	198
<i>occidentalis</i> (<i>Gentiana</i>)	216	<i>parviflora</i> (<i>Physostegia</i>)	220
<i>occidentalis</i> (<i>Platanus</i>)	200	<i>parviflorum</i> (<i>Cypripedium</i>)	183
<i>occidentalis</i> (<i>Rubus</i>)	200	<i>Pastinaca</i>	214
<i>occidentalis</i> (<i>Symphoricarpos</i>)	226	<i>patens</i> (<i>Anemone</i>)	194
<i>occidentalis</i> (<i>Thuja</i>)	170	<i>Patientia</i> (<i>Rumex</i>)	189
<i>ochroleucus</i> (<i>Lathyrus</i>)	206	<i>patula</i> (<i>Atriplex</i>)	191
<i>octandra</i> (<i>Æsculus</i>)	209	<i>patula</i> (<i>Hystrix</i>)	175
<i>odorata</i> (<i>Hierochloë</i>)	173	<i>patula</i> (<i>Solidago</i>)	230
<i>odorata</i> (<i>Nymphaea</i>)	193	<i>pauciflorum</i> (<i>Desmodium</i>)	205
<i>Oenothera</i>	212	<i>pectinatus</i> (<i>Potamogeton</i>)	171
<i>officinale</i> (<i>Cynoglossum</i>)	218	<i>pedatum</i> (<i>Adiantum</i>)	169
<i>officinale</i> (<i>Lithospermum</i>)	219	<i>pedicellaris</i> (<i>Salix</i>)	185
<i>officinale</i> (<i>Sisymbrium</i>)	197	<i>Pedicularis</i>	223
<i>officinale</i> (<i>Symphitum</i>)	219	<i>peltatum</i> (<i>Podophyllum</i>)	196
<i>officinale</i> (<i>Taraxacum</i>)	228	<i>pennsylvanica</i> (<i>Cardamine</i>)	198
<i>officinalis</i> (<i>Asparagus</i>)	181	<i>pennsylvanica</i> (<i>Carex</i>)	178
<i>officinalis</i> (<i>Fumaria</i>)	196	<i>pennsylvanica</i> (<i>Fraxinus</i>)	216
<i>officinalis</i> (<i>Mellilotus</i>)	204	<i>pennsylvanica</i> (<i>Parietaria</i>)	188
<i>officinalis</i> (<i>Saponaria</i>)	192	<i>pennsylvanica</i> (<i>Prunus</i>)	203
<i>ohioensis</i> (<i>Solidago</i>)	230	<i>pennsylvanica</i> (<i>Saxifraga</i>)	199
<i>oleracea</i> (<i>Portulaca</i>)	192	<i>pennsylvanicum</i> (<i>Polygonum</i>)	189
<i>oleraceus</i> (<i>Sonchus</i>)	228	<i>pennsylvanicum</i> (<i>Vaccinium</i>)	215
<i>Onagra</i>	212	<i>pennsylvanicum</i> (<i>Xanthium</i>)	229
<i>Onobrychis</i> (<i>Psoralea</i>)	205	<i>pennsylvanicus</i> (<i>Ranunculus</i>)	195
<i>Onoclea</i>	170	<i>pentandra</i> (<i>Salix</i>)	185
<i>Onosmodium</i>	219	<i>Penthorum</i>	199
<i>ophioglossoides</i> (<i>Pogonia</i>)	183	<i>Pentstemon</i>	222
<i>Opulaster</i>	200	<i>Peplus</i> (<i>Euphorbia</i>)	207
<i>opulifolius</i> (<i>Physocarpus</i>)	200	<i>Peranthis</i>	184
<i>Opulus</i> (<i>Viburnum</i>)	225	<i>peregrina</i> (<i>Veronica</i>)	223
<i>Orchis</i>	183	<i>perennans</i> (<i>Agrostis</i>)	173
<i>orientale</i> (<i>Polygonum</i>)	190	<i>perenne</i> (<i>Lolium</i>)	175
<i>orientalis</i> (<i>Conringia</i>)	198	<i>perfoliata</i> (<i>Uvularia</i>)	180
<i>Orobanchë</i>	224	<i>perfoliatum</i> (<i>Eupatorium</i>)	229
<i>oryzoides</i> (<i>Leersia</i>)	173	<i>perfoliatum</i> (<i>Salpiglossum</i>)	233
<i>Oryzopsis</i>	173	<i>perfoliatum</i> (<i>Triosteum</i>)	225
<i>Osmorhiza</i>	21	<i>perforatum</i> (<i>Hypericum</i>)	210
<i>Osmunda</i>	169	<i>Persicaria</i> (<i>Polygonum</i>)	189
<i>ovale</i> (<i>Ranunculus</i>)	195	<i>petaloides</i> (<i>Antennaria</i>)	233
<i>ovata</i> (<i>Carya</i>)	186	<i>petiolaris</i> (<i>Helianthus</i>)	234
<i>Ostrya</i>	186		
<i>ovina</i> (<i>Festuca</i>)	175		
<i>Oxalis</i>	206		
<i>oxyacanthoides</i> (<i>Ribes</i>)	200		
<i>Oxybaphus</i>	191		

	PAGE		PAGE
petiolaris (Salix)	185	ptarmicoides (Aster)	232
Phaca	205	Ptelea	206
Phalaris	173	Pteridium	169
philadelphicus (Erigeron)	232	Pteris	169
philadelphicum (Lilium)	181	pubescens (Sambucus)	225
Philotria	172	pubescens (Carex)	178
Phleum	173	pubescens (Cypripedium)	183
Phlox	218	pubescens (Euphorbia)	207
Phragmites	174	pubescens (Goodyera)	184
Phryma	224	pubescens (Physalis)	221
Physalis	221	pubescens (Viburnum)	225
Physocarpus	200	pubescens (Viola)	211
Physostegia	220	pulchella (Lactuca)	228
phytolaccoides (Asclepias)	217	pulchellus (Calopogon)	183
Pilea	183	pulchellus (Erigeron)	232
pilosa (Luzula)	180	pulegioides (Hedeoma)	221
pilosa (Phlox)	218	Pulsatilla	194
pinnata (Lepachys)	233	pumila (Betula)	187
Pinus	170	pumila (Pilea)	188
Pitcheri (Amphicarpa)	206	punctata (Crataegus)	202
plantaginea (Gyrostachys)	184	punctatum (Polygonum)	190
Plantago	224	puniceus (Aster)	231
plantaginifolia (Antennaria)	233	purpurascens (Asclepias)	217
Plantago-aquatica (Alisma)	171	purpurascens (Thalictrum)	195
platanoides (Quercus)	187	purpurea (Cardamine)	198
Platanus	200	purpurea (Ipomoea)	217
Poa	174	purpurea (Salix)	186
Podophyllum	196	purpurea (Sarracenia)	199
Pogonia	183	purpureum (Eupatorium)	229
Polanisia	199	Purshii (Plantago)	224
Polemonium	218	Pycnanthemum	221
polycarpa (Ludwigia)	212	pycnostachya (Liatris)	229
polycephalum (Gnaphalium)	233	Pyrola	215
Polygala	207	Pyrus	202
polygamum (Thalictrum)	195		
Polygonatum	181	quadriflorum (Steironema)	216
polygonifolia (Euphorbia)	207	Quercus	187
polygonorum (Cuscuta)	218	quinquefolia (Ampelopsis)	210
Polygonum	189	quinquefolia (Anemone)	194
Polymnia	233	quinquefolia (Gentiana)	216
polyrhiza (Spirodela)	179	quinquefolium (Panax)	213
polystachyon (Eriophorum)	176		
Polytaenia	214	racemosa (Aralia)	213
Pontica (Artemisia)	236	racemosa (Sambucus)	225
Populus	184	racemosa (Smilacina)	181
porrifolius (Tragopogon)	228	racemosa (Ulmus)	188
Porterianum (Panicleum)	172	racemosus (Symphoricarpos)	226
Portulaca	192	radicans (Rhus)	208
Potamogeton	171	ramosus (Erigeron)	232
Potentilla	201	Ranunculus	195
præcox (Carex)	178	Raphanus	197
pratense (Phleum)	173	rapunculoides (Campanula)	227
pratense (Trifolium)	204	Ratibida	233
pratensis (Tragopogon)	227	recurvatum (Trillium)	182
pratensis (Cardamine)	197	recurvatus (Ranunculus)	195
pratensis (Poa)	174	regalis (Osmunda)	169
Prenanthes	228	reniformis (Cacalia)	236
prenanthoides (Aster)	231	repens (Agropyron)	175
Preslii (Euphorbia)	207	repens (Lespedeza)	205
procumbens (Gaultheria)	215	repens (Mitchella)	224
procumbens (Trifolium)	204	repens (Oxalis)	206
Proserpinaca	213	repens (Ranunculus)	195
proserpinacoides (Flörkea)	208	repens (Trifolium)	204
prostratum (Ribes)	200	reptans (Polemonium)	218
pruinosa (Crataegus)	203	resinosa (Gaylussacia)	215
Prunella	220	retroflexus (Amaranthus)	191
Prunus	203	revolutum (Thalictrum)	195
Pseudacacia (Robinia)	205	Rhamnus	209
psilostachya (Ambrosia)	229	rhizophyllus (Camptosorus)	169
Psoralea	205	Rheas (Papaver)	196
psycodes (Habenaria)	183	rhombipetala (Ceanothera)	212

	PAGE		PAGE
rhomboldeus (<i>Ranunculus</i>)	195	Saxifraga	199
Rhus	208	Saya (<i>Rosa</i>)	202
Rhynchospora	200	scaberrimus (<i>Helianthus</i>)	234
Ribes	200	scabra (<i>Hellopsis</i>)	233
<i>Richardsonianus</i> (<i>Juncus</i>)	180	scabrella (<i>Solidago</i>)	230
Ricinus	207	scabriuscula (<i>Viola</i>)	211
Riddellii (<i>Solidago</i>)	230	scabrum (<i>Hieracium</i>)	228
rigida (<i>Sagittaria</i>)	171	scandens (<i>Celastrus</i>)	208
rigida (<i>Solidago</i>)	230	scariola (<i>Lactuca</i>)	228
rigida (<i>Tiedemannia</i>)	214	sceleratus (<i>Ranunculus</i>)	195
ringens (<i>Mimulus</i>)	222	scirpoidea (<i>Carex</i>)	178
rivale (<i>Geum</i>)	202	Scirpus	176
Robinia	205	scoparia (<i>Carex</i>)	179
Romanzoffiana (<i>Spiranthes</i>)	184	scoparius (<i>Andropogon</i>)	172
Roripa	197	Scrophularia	222
Rosa	202	scrophulariaefolia (<i>Agastache</i>)	220
rosea (<i>Carex</i>)	178	Scutellaria	219
roseus (<i>Streptopus</i>)	181	scutellata (<i>Veronica</i>)	222
rostrata (<i>Corylus</i>)	186	secalinus (<i>Bromus</i>)	175
rostrata (<i>Salix</i>)	185	secunda (<i>Pyrola</i>)	215
rostratum (<i>Solanum</i>)	221	sedoides (<i>Penthorum</i>)	199
rotundifolia (<i>Amelanchier</i>)	202	Sedum	199
rotundifolia (<i>Campanula</i>)	227	Senecio	236
rotundifolia (<i>Drosera</i>)	199	Senega (<i>Polygala</i>)	207
rotundifolia (<i>Malva</i>)	210	sensibilis (<i>Onoclea</i>)	170
rotundifolia (<i>Pyrola</i>)	215	seplum (<i>Convolvulus</i>)	218
rotundifolium (<i>Ribes</i>)	200	septentrionalis (<i>Glyceria</i>)	175
rubellus (<i>Lycopus</i>)	221	septentrionalis (<i>Ranunculus</i>)	195
rubiginosa (<i>Rosa</i>)	202	sera (<i>Cratægus</i>)	208
rubra (<i>Actæa</i>)	194	Sericocarpus	231
rubra (<i>Quercus</i>)	187	serissima (<i>Salix</i>)	185
rubrum (<i>Acer</i>)	200	serotina (<i>Prunus</i>)	203
rubrum (<i>Ribes</i>)	200	serotina (<i>Solidago</i>)	230
Rubus	233	serpyllifolia (<i>Veronica</i>)	223
Rudbeckia	197	sertata (<i>Cratægus</i>)	202
ruderales (<i>Lepidium</i>)	224	setacea (<i>Carex</i>)	178
Rugelli (<i>Plantago</i>)	187	Setaria	172
rugosa (<i>Alnus</i>)	187	Shepardia	211
rugosa (<i>Solidago</i>)	230	Shortii (<i>Aster</i>)	231
Rumex	189	siccata (<i>Carex</i>)	179
rustica (<i>Nicotiana</i>)	222	Silene	192
rutila (<i>Cratægus</i>)	203	Silphium	233
sabina (<i>Juniperus</i>)	170	simplex (<i>Aster</i>)	232
saccharinum (<i>Acer</i>)	209	simplex (<i>Sparganium</i>)	171
saccharum (<i>Acer</i>)	209	sinuatus (<i>Lycopus</i>)	221
Sagittaria	171	Sisymbrium	197
sagittatum (<i>Polygonum</i>)	190	Sisyrinchium	182
sagittifolia (<i>Lactuca</i>)	228	Sium	214
sagittifolius (<i>Aster</i>)	231	Smilacina	181
salicifolia (<i>Spiræa</i>)	200	Smilax	182
Salix	185	Solanum	221
Salomonita	181	Solidago	230
Salsola	191	somniferum (<i>Papaver</i>)	196
Sambucus	225	Sonchus	228
Samolus	216	Sorbus	202
sanguinale (<i>Digitaria</i>)	172	sororia (<i>Viola</i>)	211
Sanguinaria	196	Sparganium	171
Sanicula	213	sparganoides (<i>Carex</i>)	178
Saponaria	192	spartea (<i>Stipa</i>)	173
Saponaria (<i>Gentiana</i>)	216	Spartina	174
Sarracenia	199	Spathyema	179
Sartwellii (<i>Carex</i>)	178	speciosa (<i>Solidago</i>)	230
sativa (<i>Avena</i>)	174	spectabilis (<i>Galeorchis</i>)	183
sativa (<i>Camellina</i>)	198	spectabilis (<i>Orchis</i>)	183
sativa (<i>Cannabis</i>)	188	spicata (<i>Amelanchier</i>)	202
sativa (<i>Medicago</i>)	204	spicata (<i>Danthonia</i>)	174
sativa (<i>Pastinaca</i>)	214	spicata (<i>Liatris</i>)	229
sativa (<i>Vicia</i>)	205	spicata (<i>Lobelia</i>)	227
sativus (<i>Raphanus</i>)	197	spicata (<i>Mentha</i>)	221
Savastana	173	spicatum (<i>Acer</i>)	209
		spicatum (<i>Aplectrum</i>)	184

	PAGE		PAGE
spicatum (Myriophyllum)	213	Teucrium	219
spinosa (Cleome)	199	texensis (Croton)	207
spinosa (Prunus)	203	<i>Thalesia</i>	224
spinulosum (Aspidium)	169	thalictroides (Anemonella)	194
Spiraea	200	thalictroides (Caulophyllum)	196
spiralis (Vallisneria)	172	Thalictrum	195
Spiranthes	184	Thapsus (Verbascum)	222
Spirodela	179	Thaspium	214
splthamæus (Convolvulus)	213	Thelypteris (Aspidium)	169
Sporobolus	173	Theophrasti (Abutilon)	210
squarrosa (Grindelia)	229	Thlaspi	197
Stachys	220	Thuja	170
Steironema	216	thyrsiflora (Lysimachia)	216
Stellaria	192	Tiedemannia	214
stellata (Quercus)	187	Tilia	210
stellata (Silene)	192	tinctoria (Genista)	204
stellata (Smilacina)	181	tinctorium (Gallium)	225
Stelleri (Cryptogramma)	169	Tofieldia	180
stellulata (Carex)	178	tomentosa (Cratægus)	203
sterilis (Carex)	178	Tradescanti (Aster)	232
Stipa	173	Tradescantia	179
stipata (Carex)	178	Tragopogon	227
stolonifera (Cornus)	215	Tragus (Salsola)	191
Stramonium (Datura)	222	tremuloides (Populus)	184
Streptopus	181	triacanthos (Gleditsia)	204
striata (Melica)	174	<i>Triadenum</i>	210
stricta (Carex)	177	tribuloides (Cenchrus)	172
stricta (Gyrostachys)	184	trichocarpa (Carex)	177
stricta (Oxalis)	206	<i>trichophyllum (Batrachium)</i>	195
stricta (Solidago)	230	trichosperma (Bidens)	235
stricta (Verbena)	219	tricoecum (Allium)	180
strictum (Geum)	201	Trientalis	216
strigosus (Cyperus)	176	trifida (Ambrosia)	229
strigosus (Rubus)	200	trifida (Diervilla)	226
strobilus (Pinus)	170	trifidum (Gallium)	225
strumarium (Xanthium)	229	triflora (Poa)	174
strumosus (Helianthus)	234	triflorum (Gallium)	225
Struthiopteris (Onoclea)	170	triflorum (Solanum)	221
suaveolens (Cacalia)	236	triflorus (Rubus)	200
subrotundifolia (Cratægus)	203	trifolia (Coptis)	193
subsagittata (Viola)	211	trifolia (Smilacina)	181
Sullivantii (Lonicera)	226	trifoliata (Menyanthes)	217
superbum (Lilium)	181	trifoliata (Ptelea)	206
sylvatica (Muhlenbergia)	173	trifoliata (Sanicula)	213
sylvaticum (Equisetum)	170	<i>trifoliatum (Thaspium)</i>	214
sylvestris (Malva)	210	Trifolium	204
Symphoricarpos	226	trifolium (Panax)	213
Symphytum	219	Triglochin	171
Symplocarpa	179	Trillium	182
<i>Syndesmon</i>	194	triloba (Hepatica)	194
<i>Synosma</i>	236	Trionum (Hibiscus)	210
<i>Syntherisma</i>	172	Trilostemum	225
syphilitica (Lobelia)	227	triphyllum (Arisæma)	179
syriaca (Asclepias)	217	trisperma (Carex)	179
		tristis (Salix)	186
Tænidia	214	trisulca (Lemna)	179
Tanacetum	235	tuberosa (Asclepias)	217
tamariscina (Acnida)	191	tuberosa (Apios)	206
Taraxacum	228	tuberosus (Helianthus)	234
tarda (Cratægus)	203	tuberculata (Acnida)	191
tatarica (Lonicera)	226	tulipifera (Liriodendron)	193
Tatula (Datura)	222	Typha	171
Telephium (Sedum)	199	typhina (Rhus)	208
tenella (Carex)	178		
tenuiflora (Carex)	179	<i>uliginosa (Pyrola)</i>	215
<i>tenuifolia (Cratægus)</i>	203	uliginosum (Gnaphallum)	233
tenuifolia (Gerardia)	223	ulmifolia (Solidago)	230
<i>tenuifolia (Stachys)</i>	220	Ulmus	188
tenuis (Eleocharis)	176	umbellata (Comandra)	188
terebinthinaceum (Silphium)	233	umbellata (Doellingeria)	232
Tetrahit (Galeopsis)	220	<i>umbellatum (Lilium)</i>	181

undulatus (Aster)	231	virginiana (Physalis)	221
uniflora (Monotropa)	215	virginiana (Physostegia)	220
uniflora (Orobanche)	224	virginiana (Prunus)	203
<i>Unifolium</i>	181	virginiana (Rosa)	202
Urtica	188	virginiana (Tradescantia)	179
urticaefolia (Verbena)	219	virginianum (Botrychium)	169
<i>Urticastrum</i>	188	virginianum (Geum)	201
usitatissimum (Linum)	206	virginianum (Polygonum)	190
Utricularia	223	virginica (Acalypha)	207
Uva-ursi (Arctostaphylos)	215	virginica (Claytonia)	192
Uvularia	180	virginica (Krigia)	227
		virginica (Leersia)	172
Vaccaria (Saponaria)	192	virginica (Veronica)	223
Vaccaria	192	virginicum (Cynoglossum)	218
Vaccinium	215	virginicum (Hydrophyllum)	218
Vagnera	181	virginicum (Hypericum)	210
Valeriana	226	virginicum (Lepidium)	197
validus (Scirpus)	176	virginicus (Elymus)	175
Vallisneria	172	virginicus (Lycopus)	221
variegatum (Equisetum)	170	virididis (Mentha)	221
velutina (Quercus)	187	viridis (Setaria)	172
venosus (Hieracium)	228	virosa (Lactuca)	172
venosus (Lathyrus)	206	viscosum (Cerastium)	228
Verbascum	222	Vitis	193
Verbena	219	vitellina (Salix)	210
verna (Callitriche)	185	vulgare (Echium)	185
Vernix (Rhus)	208	vulgare (Lycium)	219
Vernonia	208	vulgare (Tanacetum)	222
Veronica	229	vulgaris (Aquilegia)	233
versicolor (Iris)	223	vulgaris (Artemisia)	194
versicolor (Scutellaria)	182	vulgaris (Berberis)	235
verticillata (Ilex)	220	vulgaris (Linaria)	196
verticillata (Mollugo)	208	vulgaris (Phragmites)	222
verticillatus (Rumex)	192	vulgaris (Prunella)	174
verum (Gallum)	189	vulgaris (Senecio)	220
vesca (Fragaria)	224	vulgaris (Sillene)	236
vesicaria (Carex)	201	vulgaris (Utricularia)	192
Viburnum	177	vulgata (Bidens)	223
Vicia	225	vulgatum (Cerastium)	234
villosa (Dioscorea)	205	vulpina (Vitis)	210
viminalis (Salix)	182	vulpinoidea (Carex)	193
Viola	186		178
virginiana (Anemone)	211		
virginiana (Clematis)	194	<i>Washingtonia</i>	213
virginiana (Epiphegus)	194	Wolfgangiana (Anemone)	194
virginiana (Fragaria)	224		
virginiana (Hamamelis)	201	xanthifolia (Iva)	229
virginiana (Juniperus)	200	Xanthium	229
virginiana (Kallia)	170	Xanthoxylum	206
virginiana (Lappula)	221		
virginiana (Ostrya)	218	Zizania	172
	186		

A NEW SPECIES OF PSEN.

BY HENRY L. VIERECK.

Psen (Mimesa) barthi n. sp.

Wings brownish transparent, nervures and stigma dark brown. Belongs to Fox's group *Kohli*, but clypeus subbidentate.

Female. 10 mm. *Head*: Pretty much the same as in *simplicicornis*; polished portions with a steel blue reflection.

Thorax: Dorsulum approximately as in *simplicicornis*; scutellum punctured and striate; mesopleura distinctly but sparsely punctured; dorsulum and mesopleura with a steel blue reflection; knees black, spurs whitish, tarsi brownish testaceous to brown; otherwise as in *simplicicornis*.

Abdomen: Pygidium bounded by a distinct carina; otherwise as in *simplicicornis*.

Barring the exceptions already alluded to, this insect is almost uniformly black.

Type Public Museum, Milwaukee, Wis. Type locality, Milwaukee, Wis. One specimen collected by Dr. Geo. P. Barth.

ON THE NESTING HABITS OF *PSEN BARTHI* VIERECK

BY GEORGE P. BARTH.

Revenge is sweet. This spirit may have tinged the feeling of satisfaction which was derived from demolishing the abiding place of the above described intruder on what I fondly regarded as my crabro preserve. During the years 1905 and 1906 this old log in Bradley's Woods, on the Milwaukee-Waukesha County line, had been a continuous source of pleasure and profit to me in my

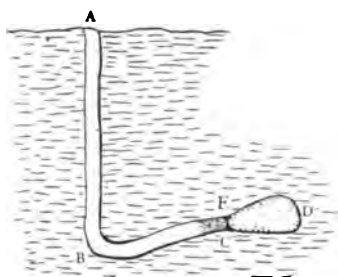
growing intimacy with the habits of the Crabronidæ and a feeling of disappointment and chagrin was experienced when it was seen that a colony of slender, black wasps had usurped this haunt of a more beautiful though coarser structured family. Nothing remained of the numbers of *Crabro obscurus*, *chrysarginus*, *sex-maculatus* and *montanus* which formerly nested here. During the summer but one *Crabro brunneipes* ventured to dispute the right of possession with *Psen* and built her nest in the log. One specimen of *Psen* was caught carrying a leaf-hopper to this log last year, but others must have builded to account for the numbers that chose this for a nesting site during the present season.

The flight of the wasp is rather slow and not graceful. When hunting for a place to begin excavations she frequently alights and tests rather methodically here and there, walking from place to place, occasionally taking wing along the log in arcs with the side of the log. She is not at all shy, seemingly indifferent as to whether she is being watched or not even though the observer be quite close to the nest. The numerous parasitic flies which were constantly about the nests also did not seem to be a disturbing factor, although several times the returning wasp lunged at one which happened to be too close to the entrance. The prey of the wasp seems to be exclusively adult leap-hoppers, of which the following species were found in the nests: *Cyrtolobus fenestratus* Fitch and *Atyma inornata* Say.

The method of carrying the hopper was practically the same in all instances. It was firmly grasped at the neck or anterior part of the thorax by the middle legs, ventral or lateral side uppermost, and projected backwards under the abdomen of the wasp. Occasionally the body was carried somewhat to the right side and below thus pushing the abdomen of the wasp to the left. In no instance was the wasp seen to fly directly into the nest, but alighted some inches away and deliberately walked in without shifting its grasp on its victim.

NEST.

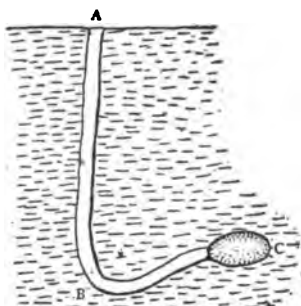
The entrance to the nest was usually marked by a quantity of sawdust scattered about without definite form or arrangement. The nest remained open during the absence of the wasp though material was at hand with which it might easily have been closed to intruders. Frequently the entrance was in the side of a crack which extended into the log and in this event the sawdust was in large part carried to the surface and deposited there. A short gallery, smooth and evenly rounded, from three to four millimeters in diameter, led perfectly straight or rather tortuously to the cells. The accompanying drawings and measurements will illustrate. In all nests the cell was rather sharply divided from the gallery by a ridge formed by the abrupt incline into the bowl of the cell. In shape these varied to a considerable degree, the oval in some form being maintained however. The cell was provisioned with from three to five leaphoppers which were in the majority of cases mixed with a little sawdust. These, presumably, were stung to death as neither the ones taken from the wasp immediately on her return from a hunting expedition nor those in any of the cells responded to stimulation with forceps, fingers or alcohol and they soon dried up. All the nests except number three were in the log. This nest was found in the debris which littered the ground about one foot from the log proper, the entrance being concealed under several chips of wood. Thence it took its course downward irregularly, then horizontally and finally in a sweeping curve downward to the cell. This irregularity was not due to a desire on the part of the wasp to avoid obstructions as where a piece of wood was encountered the wasp bored its way through instead of around it, at least three pieces of wood, none larger than three-fourths of an inch in any diameter being thus perforated. The cell itself occupied the center of a small square piece not over one inch each way.

**Nest No. 1.**

Gallery A to C 0.4 cm. in diameter.
B to D 4.5 cm.

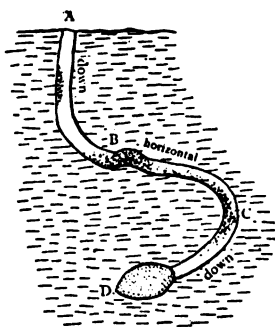
At E 0.8 cm. of packed sawdust.

Cell 1.2x0.6 cm; irregularly oval.
Entrance 0.3 cm.
4-leaf hoppers.

**Nest No. 2.**

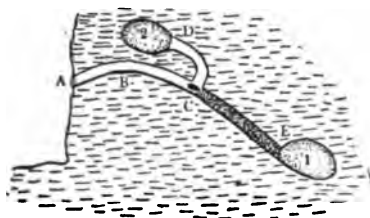
Gallery A to B extending vertically. 0.4 cm. in diameter; B to C = 4 cm. horizontally.

Cell regularly oval; 1.0x0.7 cm. Entrance 0.4 cm. Contained 2 hoppers.

**Nest No. 3.**

Gallery C to D = 5 cm. in a sweeping curve. C to B = 6 cm., also curved. B to A = 5 cm., almost straight. A to D in a straight line = 11 cm.

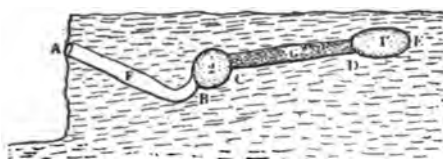
Cell Egg-shaped as drawn; 1.3x0.7 cm. Entrance 0.4 cm. Contained 2 hoppers.

**Nest No. 4.**

Gallery E filled with sawdust and 0.3 cm. in diameter. D and B open. D = 1½ cm. long.

Cell 1 Irreg. oval; 1.2x0.7 cm.; clean and contained a cocoon very lightly attached to the walls.

Cell 2 regularly oval; empty and clean; 1.0x0.6 cm.

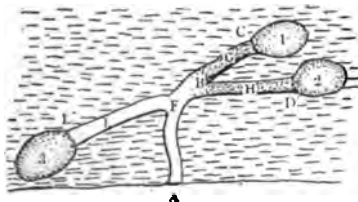
**Nest No. 5.**

Gallery A to B = 2.2 cm.
C to D = 1.5 cm.
A to E = 5.9 cm.
A to D = 4.6 cm.
G = 0.3 cm. in diam. and packed with sawdust.
F = 0.4 cm. in diam. and open.

Cell 1 1.3x0.7 cm.; 3 hoppers; egg on left thorax at edge of wing beginning at neck and extending parallel to the body.

Cell 2 practically spherical; 0.8 cm. in diameter. Empty.

Wasp caught in gallery F.

**TOP VIEW.**

A to D = 4 cm.

A to C = 3 cm.

A to L = 3.7 cm.

A to F = 1.2 cm.

D to B = 1.7 cm.

C to B = 0.6 cm.

F to L = 2.5 cm.

Nest No. 6.**LATERAL VIEW.**

Cell 1 1.0x0.6 cm.; 3 hoppers; contents mildewed.

Cell 2 1.3x0.6 cm.; rather flat on one side, dome-like on other; cocoon.

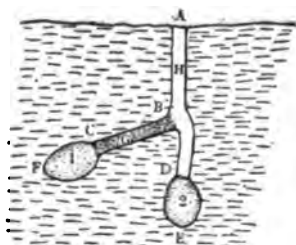
Cell 3 1.2x0.6 cm.; empty.

Gallery H 0.3 cm. in diam.; filled with sawdust.

Gallery g 0.4 cm.; filled with sawdust.

Gallery I 0.4 cm.; open.

Wasp caught in nest. Entrance in a crack.

**Nest No. 7.**

A to B = 1.8 cm.

B to C = 2 cm.

B to D = 1 cm.

A to F = 5 cm.

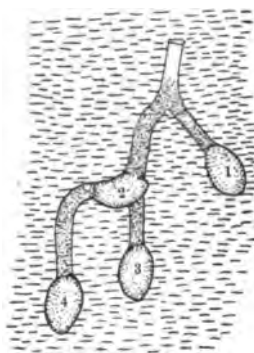
A to E = 4 cm.

Gallery H = 0.4 cm. in diam.; open.

Gallery G = 0.3 cm. in diam.; packed.

Cell 1 a cocoon.

Cell 2 1.1x0.7 cm. Empty.

**Nest No. 8.**
SURFACE VIEW.

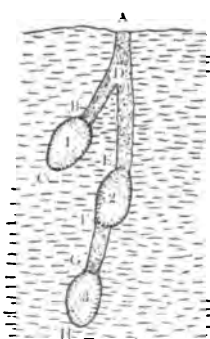
Galleries and cells were practically on the same horizontal plane, the entrance being in a crack in the log. All the galleries were packed with sawdust.

Cell 1 1.2x0.7 cm.; contained a cocoon.

Cell 2 very irregular in shape; contents mildewed.

Cell 3 1.3x0.6 cm.; regularly oval; contained a cocoon.

Cell 4 1.2x0.6 cm.; regularly oval; contained a cocoon.

**Nest No. 9.**

All the cells and galleries on practically the same vertical plane. All galleries packed with sawdust.

A to D = 1.5 cm.

A to B = 2.7 cm.

A to C = 3.8 cm.

A to E = 3.7 cm.

A to H = 7.0 cm.

F to G = 1.2 cm.

Cell 1 1.1x0.7 cm.; regularly oval; 3 hoppers; entrance 0.3 cm. in diam.

Cell 2 1.1x0.5 cm.; regularly oval; 4 hoppers.

Cell 3 1.1x0.6 cm.; one side considerably flatter than the other; 4 hoppers; egg on right thorax along the edge of the wing; contents beginning to mildew.

MISCELLANEOUS CELLS OF WHICH THE NEST STRUCTURE WAS NOT TRACED.

Cell No. 1: 1.1x0.5 cm.; empty; sharply differentiated from gallery; regularly oval; 0.35 cm. at entrance; gallery 0.4 cm. not packed.

Cell 2. 1.2x0.7; 4 hoppers somewhat mildewed; regularly oval; gallery to cell packed with sawdust.

Cell 3. 1.1x0.7 cm.; regularly oval; 4 hoppers.

Cell 4. 1.1x0.6 cm.; regularly oval; 5 hoppers; a small fly larva crawling about.

Cell 5. 1.0x0.6 cm.; regularly oval; 3 hoppers; egg on right thorax along edge of wing.

Cell 6. 1.2x0.7; egg shaped; entrance packed with sawdust and somewhat smaller than the gallery beyond; 3 hoppers.

Cell 7. 1.0x0.6 cm.; irregularly oval, one side being somewhat flattened; 3 hoppers; 3 fly larvae in cell.

Cell 8. Very irregular; contents mildewed.

Cell 9. Irregularly oval; 1.2x0.6 cm.; 3 hoppers; 2 fly larvae.

Cell 10. 1.1x0.5 cm.; regularly oval; cell and gallery empty; sharply differentiated by ridge; 0.35 cm. at entrance to cell; 0.4 cm. in gallery.

In no case did the hoppers completely fill the cell, being gathered in a ball either at one end or in the middle. Most of the cocoons, however, filled the cell and were lightly attached to its walls with the hopper rests attached to its outer surface.

The cocoons are buff or yellowish buff in color, frequently with whitish fibres or masses of fibre scattered over the surface. One larva in an artificial glass cell spun a cocoon which is entirely paper white. They are rather tough, tearing with difficulty, though quite thin.

Nests one, two and three were excavated August 4th. The remainder were obtained September 1st. On this day but two wasps were seen about the log, one resting in the gallery of Nest No. 5 and the other carrying prey into Nest No. 6.

LIST OF MEMBERS OF THE WISCONSIN NATURAL HISTORY SOCIETY.

ACTIVE MEMBERS.

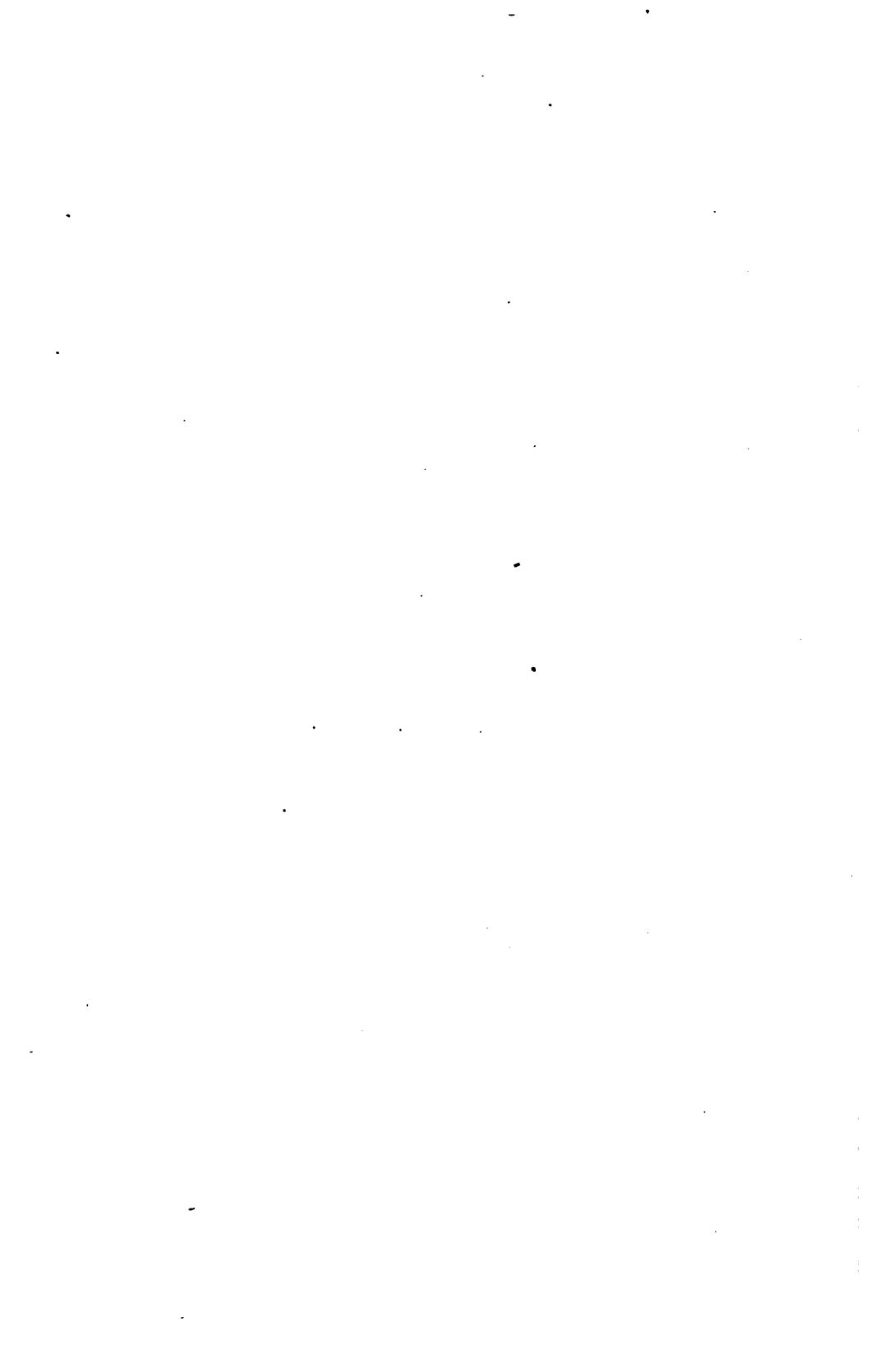
Dr. A. W. Akerly.....	Nat. Soldiers' Home, Wauwatosa. Wis.
Clarence J. Allen.....	555 Juneau Place.
Hugo Altschwager.....	118 Harmon St.
Dr Edwin P. Bartlett.....	422 Jefferson St.
Dr. Geo. P. Barth.....	Goldsmith Bldg.
Dr. Wm. A. Batchelor.....	1109 Kinnickinnic Ave.
Adolph Biersach.....	1011 Second St.
Mrs. A. Bernhardt.....	1300 Grand Ave.
Val. Blatz.....	236 Prospect Ave.
C. Fred Bossert.....	719 Franklin Place.
Gottlob Bossert.....	719 Franklin Place.
Charles E. Brown.....	1214 Chestnut St.
Charles T. Brues.....	Public Museum.
Dr. A. H. Brundage.....	2404 State St.
Dr. Arthur J. Burgess.....	1102 Grand Ave.
Charles C. Carpenter.....	841 Cass St.
Miss Alice Childs.....	East Side High School.
Herbert Clowes.....	Public Museum.
Geo. W. Colles.....	Alhambra Bldg.
Dr. A. Ivans Comfort.....	National Soldiers' Home, Wauwatosa.
Dr. Ernest Copeland.....	141 Wisconsin St.
L. F. Crosby.....	2426 Wells St.
Charles H. Doerffinger.....	254 Ninth St.
Rev. Frederick Edwards.....	184 Twenty-fourth St.
B. H. Eiring.....	2918 Cedar St.
John Elser.....	472 Cass St.
Wm. Finger.....	297 Twelfth St.
Alfred Fischer.....	751 Island Ave.
Dr. E. B. Fuller.....	422 Camp Bldg.
Mrs. Albert F. Gallun.....	456 Lafayette Place.
Dr. S. Graenicher.....	551 Seventh St.
Dr. Nathaniel Gray.....	514 Goldsmith Bldg.
C. J. Habhegger.....	438 East Water St.

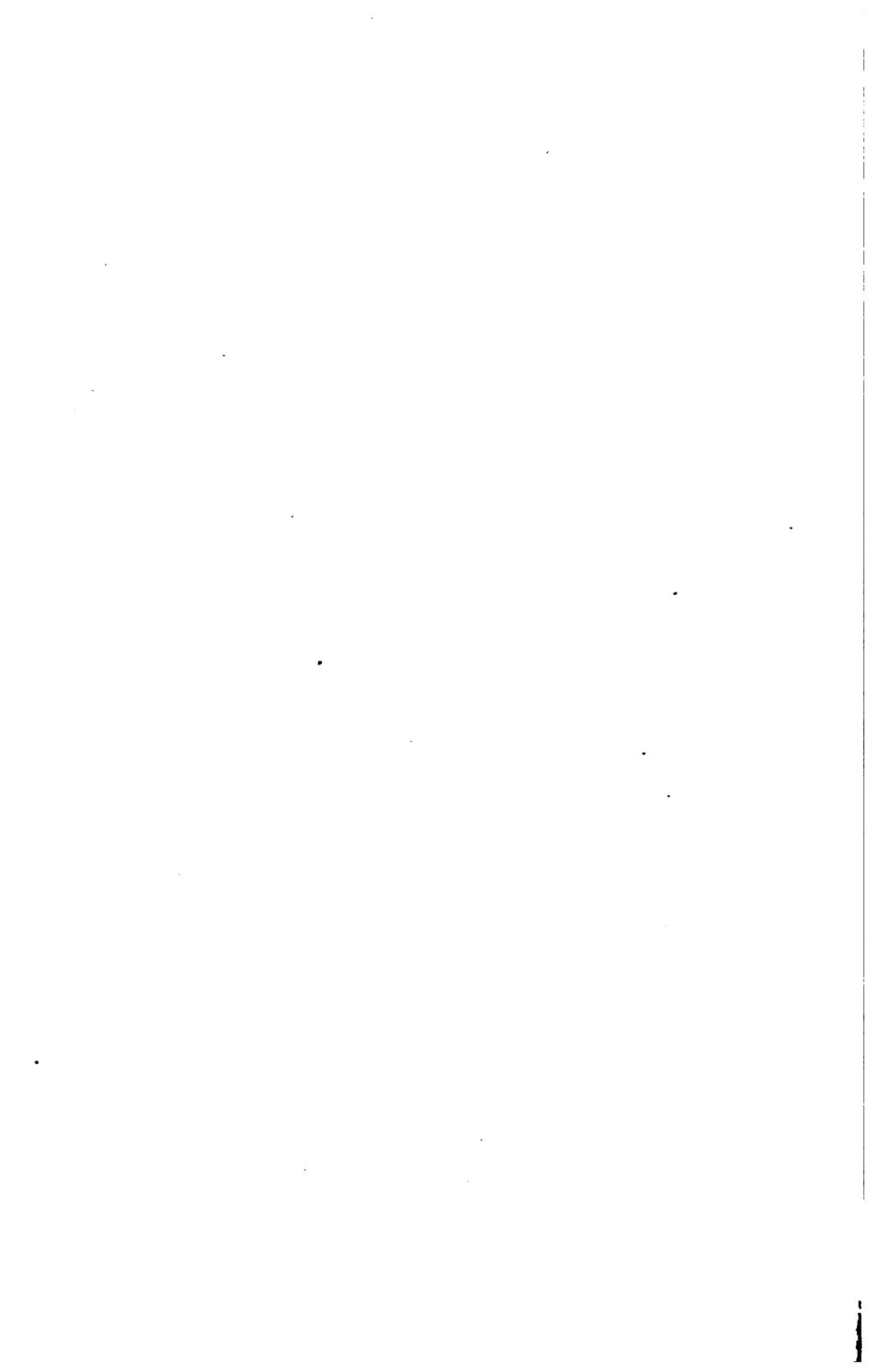
Philipp Jung.....	623 Second St.
Charles L. Kiewert.....	9 Waverly Place.
Charles A. Koeffler.....	909 Pabst Bldg.
Wm. C. Klann.....	2816 Chestnut St.
Julius Lando.....	419 East Water St.
Adolph F. Laue.....	1111 Sycamore St.
Dr. C. F. Lange.....	900 First St.
Louis Lotz.....	615 Galena St.
Hugo Lutz.....	1248 Burleigh St.
Charles L. Mann.....	124 Farwell Ave.
Robert W. Martin, Jr.....	3107 Cedar St.
Dr. Patrick H. McGovern.....	2036 Grand Ave.
Ferdinand Meinecke.....	693 Milwaukee St.
Miss Harriet B. Merrill.....	The Martin.
Dr. Geo. W. C. Meyer.....	Oconomowoc, Wis.
Benj. J. Miller, Jr.....	102 Wisconsin St.
Prof. I. N. Mitchell.....	State Normal School.
Charles E. Monroe.....	800 Pabst Bldg.
A. Monsted.....	507 Pabst Bldg.
Dr. H. V. Ogden.....	Goldsmith Bldg.
Dr. Geo. W. Peckham.....	Public Library.
J. M. Pereles.....	529 Astor St.
T. J. Pereles.....	535 Astor St.
Richard M. Philipp.....	596 Jackson St.
Albert P. Puelicher.....	137-139 Wisconsin St.
Charles Quarles.....	539 Farwell Ave.
Gustav Reuss.....	668 Sixth St.
Paul C. Rohde.....	Public Museum.
Mrs. E. Ruemmelin.....	763 Weil St.
Howland Russel.....	106 Mason St.
William Segall.....	652 Twenty-seventh St.
Dr. Lewis Sherman.....	448 Jackson St.
Geo. Shrosbree.....	Public Museum.
J. W. Skinner.....	34 New Insurance Bldg.
Mrs. Mary Steinmeyer.....	2427 Grand Ave.
Gardner P. Stickney.....	Pabst Bldg.
Edgar E. Teller.....	165 Twenty-seventh St.
Carl Thal.....	Public Museum.
Miss Ellen Torelle.....	Milwaukee-Downer College.

Charles Trieschmann.....	430 Hanover St.
Gustav J. A. Trostel.....	555 Terrace Ave.
John H. Tweedy.....	508 Marshall St.
August Uihlein.....	332 Galena St.
Wm. H. Vogel.....	108 Seventh St.
Fred Vogel, Jr.....	538 Cass St.
Henry L. Ward.....	Public Museum.
Charles B. Weil.....	286 Knapp St.
George A. West.....	97 Wisconsin St.
Gen. Fred C. Winkler.....	131 Eleventh St.
A. J. Wright.....	201 Wisconsin St.
Charles H. Junker.....	2520 Cedar St.

CORRESPONDING MEMBERS.

Dr. E. R. Buckley.....	Rolla, Mo.
Miss Florence Buck.....	247 Congress St., Kenosha, Wis.
George H. Chadwick.....	St. Lawrence University, Canton, N. Y.
W. P. Clarke.....	Milton, Wis.
Henry W. Frieden.....	Mineral Point, Wis.
N. Hollister.....	Biological Survey, Department Agriculture, Washington, D. C.
H. H. T. Jackson.....	Milton, Wis.
Miss Clara G. Jones.....	West Bend, Wis.
Rudolph Kuehne.....	825 N. Market St., Sheboygan, Wis.
F. H. Lyman.....	205 Market St., Kenosha, Wis.
Dr. D. McL Miller.....	Oconomowoc, Wis.
Rev. E. C. Mitchell.....	534 Summit Ave., St. Paul, Minn.
Miss Marion Murdock.....	247 Congress St., Kenosha, Wis.
Henry L. Skavlem.....	Janesville, Wis.
Dr. Charles E. Slocum.....	Defiance, Ohio.
H. A. Winkenwerder.....	Watertown, Wis.





BULLETIN

OF THE

Wisconsin Natural History Society

Published with the cooperation of the

Public Museum of the City of Milwaukee

VOLUME VI

(NEW SERIES)

WITH NINE PLATES

EDITED BY CHARLES T. BRUES

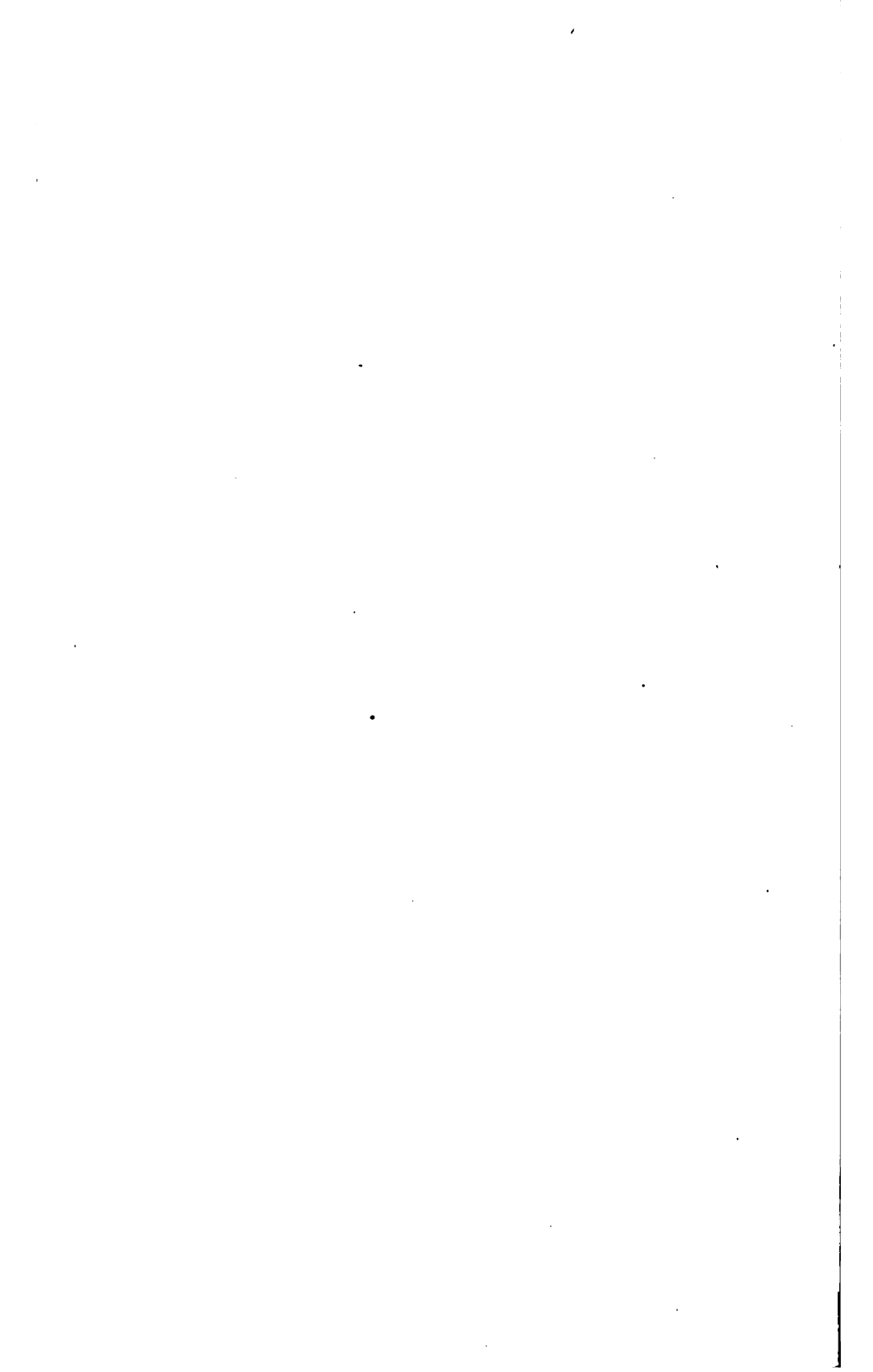
MILWAUKEE, WISCONSIN

1908

14/33
4/1-4

TABLE OF CONTENTS. VOLUME 6.

Proceedings	1
Some fossil plants from the middle Devonian of Milwaukee, Wisconsin. By D. P. Penhallow.....	8
A preliminary list of Wisconsin mammals. By Hartley H. T. Jackson	13
Fossil Cercopidæ (Homoptera). By T. D. A. Cockerell.....	33
The Pseudoscorpions of Texas. By Nathan Banks.....	39
A rapid melanistic and subsequent partial albinistic change in a caged robin. By Henry L. Ward	43
Notes and descriptions of North America Parasitic Hymenoptera. VI. By Charles T. Brues.....	48
Review of the dragon-flies of Wisconsin. By Richard Muttkowski	57
An addition to the avifauna of Wisconsin. By Henry L. Ward...	124
Proceedings	129
Notes on Wisconsin mammals. By N. Hollister.....	137
The last records of deer in Walworth county, Wisconsin. By N. Hollister	143
The American Elk in Southern Wisconsin. By Henry L. Ward..	145
The nesting of <i>Anacrabro ocellatus</i> Pack. By George P. Barth..	147
Notes and descriptions of North American Parasitic Hymenoptera VII. By Charles T. Brues.....	154
A summer's insect collecting. By Richard A. Muttkowski.....	164
A new fossil grass from the Miocene of Florissant, Colorado. By Charles T. and Beirne B. Brues.....	170
Briefer Articles	171
List of members of the Wisconsin Natural History Society.....	172



INDEX TO VOLUME VI.

New species and new names are indicated by an asterisk.

Akeley, C. E., Lecture by.....	5
Albinism in a robin.....	43
<i>Alce americanus</i> (Clinton).....	14, 138
<i>Alle alle</i>	124, 129
American elk.....	15
<i>Anacrabro ocellatus</i> Pack, nesting of.....	147
* <i>Antiseptyris rugosicollis</i> Brues.....	48
<i>Antennaria</i> , notes on.....	132
* <i>Aphanomerus americanus</i> Brues.....	156
* <i>Asaphes rufipes</i> Brues.....	160
<i>Aster Drummondi</i>	134
Asters, exhibit of.....	1
Badger, American.....	28, 141
Banks, Nathan, on Texan pseudoscorpions.....	39
Barth, Geo. P., exhibit of specimens of insects.....	133
Barth, Geo. P., on the nesting of <i>Anacrabro ocellatus</i> Pack.....	117
Barth, Geo. P., remarks on wasp nests.....	134
Bat, hoary.....	33, 142
little brown.....	22
red.....	53
Say's.....	142
silver-haired.....	32
Bear, black.....	30
Beaver, American.....	19
Bees, lecture on habits of.....	3
* <i>Bephratoides maculatus</i> Brues.....	158
Birds, lecture on brooding habit in.....	7
Bison bison (Linn.).....	14, 138
* <i>Blacus gracilis</i> Brues.....	55
<i>Blarina brevicauda</i> (Say).....	32
Brues, C. T., on North American Parasitic Hymenoptera.....	48, 151
Brues, C. T. & B. B., on a fossil grass from Florissant, Col.....	174
Burrill, A. C., lecture on irrigation by.....	135
Canadian lynx.....	25

<i>Canis griseus</i> (Sabine).....	27
<i>Canis latrans</i> Say.....	27, 141
<i>Castor canadensis</i> Kuhl.....	19, 139
* <i>Cephalonomia utahensis</i> Brues.....	154
Cercopidæ, fossil.....	35
<i>Cervus canadensis</i> (Erxleben).....	15, 137, 145
<i>Chelifer cancroides</i> Linn.....	39
<i>Chelifer muricatus</i> Say.....	39
* <i>Chelanops aqualis</i> Banks.....	41
<i>oblongus</i> Say.....	39
* <i>pulchellus</i> Banks.....	41
<i>teanus</i> Banks.....	39
* <i>tumimanus</i> Banks.....	40
* <i>nuicolor</i> Banks.....	39
Chickaree.....	16
Chipmunk, Gray.....	17
Lake Superior.....	139
little striped.....	17
* <i>Chrysocharis aneus</i> Brues.....	161
<i>Citellus franklini</i> (Sabine).....	18, 139
<i>13-lineatus</i> (Mitchell).....	18
Clowes, H., plant family list.....	175
Cockerell, T. D. A., on fossil Cercopidæ.....	35
Coleoptera as flower visitors.....	3
Colles, G. W., talk by.....	2
Comfort, A. I., talk by.....	133
<i>Condidea lata</i> Coq.....	133
<i>Condylura cristata</i> (Linn.).....	32
Copper ores, lecture on origin and deposition of.....	2
<i>Cordaites</i>	10
* <i>Cosmophorus hypothecemi</i> Brues.....	162
Coyote.....	27, 141
Deer, last records of, in Walworth Co., Wis.....	143
Dells of the Wisconsin, lecture on.....	132
Devonian plants from Milwaukee.....	8
<i>Didelphis virginiana</i> Kerr.....	14, 137
Doerflinger, C., talk by.....	7
Dovekie.....	124, 129
Dragon-flies of Wisconsin (see special index, p. 125	
Dufour, Miss Alice, lecture by.....	4
Eastern Moose.....	138
Elk.....	15
Elk, American in southern Wisconsin.....	145

<i>*Enizemum neomexicanum</i> Brues.....	54
<i>Erethizon dorsatum</i> (Linn.).....	24
<i>Eutamias borealis neglectus</i> Allen.....	139
<i>quadrivittatus neglectus</i> (Allen).....	17
Evolution, lecture on.....	6
<i>Erotomys gapperi</i> (Vigors).....	22
<i>Felis concolor</i> Linn.....	14
<i>couguar</i> Kerr.....	141
<i>Fiber zibethicus</i> (Linn.).....	23
Flower visiting Coleoptera.....	3
Fossil plants from the Devonian on Milwaukee.....	8
Fox, red.....	26, 140
Wisconsin gray.....	26, 140
<i>*Fucus berthelensis</i> Penhallow.....	11
<i>Gaillardia</i> visited by insects.....	3
<i>Geomys bursarius</i> (Shaw).....	24
Gopher	18
gray	18
pocket	24
Graenicher, S., exhibition of plants by.....	134
Graenicher, S., lecture by.....	3
Grass, new fossil from the Florissant Miocene.....	174
Ground hog.....	19
Guatemala, abstract of lecture on.....	4
<i>Gulo luscus</i> (Linn.).....	14, 141
Hare, Minnesota varying.....	25
Hollister, on deer in Walworth Co., Wisconsin.....	143
<i>*Hoploteleia noveboracensis</i> Brues.....	49
<i>Ideobisium rufulum</i> Banks.....	42
Indians of the southwest, lecture on.....	135
Irrigation, lecture on.....	134
Jackson, H. H. T., on Wisconsin mammals.....	13
<i>Lasionycteris noctivagans</i>	32
<i>Lasiurus borealis</i> (Müller).....	33
<i>cinereus</i> (Beauvois).....	33, 142
Lepidoptera of Milwaukee County.....	166
<i>Leptinotarsus</i>	130
<i>Leptura</i> , as flower visitor.....	3
<i>Lepus americanus phaeonotus</i> Allen.....	25
Linnæus, talk on life of.....	2
<i>Linum sulcatum</i>	134
<i>Lutra canadensis</i> (Schreber).....	27
<i>Lynx canadensis</i> Kerr.....	25

<i>rufus</i> (Güldenstaedt).....	25
Mammals of Wisconsin, preliminary list of.....	13
<i>Marmota monax</i> (Linn.).....	19
Marten, Pine.....	29
Melanism in a robin.....	43
* <i>Melica primæva</i> Brues.....	174
Members, list of, of Wisconsin Natural History Society.....	176
<i>Mephitis hudsonica</i> (Richardson).....	28
<i>mesomelas avia</i> (Bangs).....	13, 141
<i>Microtus ochrogaster</i> (Wagner).....	23
<i>pennsylvanicus</i> (Ord).....	22
<i>pinetorum scalopsoides</i> (Aud. & Bach).....	13
Mink, northern.....	28
Mole, large-nosed.....	142
star-nosed.....	32
Monroe, C. E., exhibition of asters by.....	1
Mouse, canadian deer.....	20
house.....	20
jumping.....	24, 140
meadow.....	22
Michigan deer.....	21
Michigan white-footed.....	140
prairie meadow.....	23
red-backed.....	22
woodland deer.....	21
<i>Mus musculus</i> (Linn.).....	20
<i>norvegicus</i> Erxleben.....	20
Muskrat.....	23
<i>Mustela americana</i> Turton.....	29
<i>pennanti</i> (Erxleben).....	14
Muttkowski, R. A., article by.....	164
on the Dragon-flies of Wisconsin.....	57
<i>Myotis lucifugus</i> (LeConte).....	32
<i>subulatus</i> (Say).....	142
<i>Nematophycus crassus</i>	10
* <i>Nematophycus milwaukeeensis</i> Penhallow.....	8
<i>Nemognatha</i> as flower visitor.....	3
<i>Neosorex palustris</i> (Richardson).....	31
* <i>Nesomyia cimbicis</i> Brues.....	162
Neuroptera of Milwaukee County.....	172
Northern deer.....	14
<i>Odocoileus americanus borealis</i> Miller.....	14
Odonata of Wisconsin, see special index, p. 125	

Odonata of Wisconsin.....	170
* <i>Ogdenia</i> Peckham.....	176
* <i>Olpium minutum</i> Banks.....	42
Opossum	14, 137
Otter	27
* <i>Oxytorus paludicola</i> Brues.....	50
<i>Palaphrodes irregularis</i> Scudder.....	35
<i>Palecphora communis</i> Scudder.....	36
Panther	141
Parasitic Hymenoptera of North America.....	48, 154
Peckham, G. W., lecture by.....	3
Peckham, G. W., on the generic name <i>Rooseveltia</i>	176
Penhallow, D. P., on fossil Devonian plants.....	8
<i>Peromyscus dairdi</i> (Hoy & Ken.).....	140
<i>canadensis</i> (Miller).....	20
<i>leucopus noveboracensis</i> (Fischer).....	21
<i>michiganensis</i> (Aud. & Bach).....	21
<i>Pithophora</i> , at Fox Lake, Wisconsin.....	134
Plains Indians, remarks on.....	133
Plant family reference list.....	175
Porcupine, Canadian.....	24
Prehistoric artifacts from Switzerland, notes on.....	7
Preliminary list of Wisconsin mammals.....	13
* <i>Proctotrypes longiusculus</i> Brues.....	155
<i>Procyon lotor</i> (Linn.).....	29
* <i>Promethes rohweri</i> Brues.....	51
Pseudoscorpions of Texas.....	39
<i>Putorius cicognanii</i> (Bonaparte).....	28
<i>longicauda spadix</i> (Bangs).....	13
<i>noveboracensis</i> Emmons.....	29
<i>rizosus alleghentensis</i> (Rhoads).....	29
<i>rison</i> (Schreber).....	29
Rabbit, prairie cottontail.....	25
Raccoon	29
Rat, brown.....	20
Robin, melanistic and albinistic change in.....	43
<i>Rooseveltia</i> Peckham.....	176
* <i>Rosneta tritici</i> Brues.....	157
<i>Rudbeckia</i> visited by insects.....	3
Russel, Howland, talk by.....	2
Sable, American.....	29
<i>Scalopus aquaticus machrinus</i> (Raf.).....	13, 142
<i>Sciuropterus sabrinus</i> (Shaw).....	19

<i>volans</i> (Linn.).....	19
<i>Sciurus carolinianus hypophæus</i> Merriam.....	15
<i>carolinianus leucotis</i> (Gapper).....	15
<i>hudsonicus loquax</i> Bangs.....	16
<i>hudsonicus Minnesota</i> Allen.....	136
<i>niger ruiventris</i> Geoffrey.....	16
Segall, Wm., lecture by.....	5
Shrew, Hoy's.....	31
marsh	31
masked	30
Richardson's	30
short-tailed	32
smoky	142
Skunk, Illinois.....	141
northern plains.....	28
<i>Sorex fumeus</i> Miller.....	13, 142
<i>hoyi</i> Baird.....	31
<i>personatus</i> I. Geoffrey.....	30
<i>richardsonii</i> Bachman.....	30
Spermophile, Franklin's.....	18
<i>Spilomyia hamifera</i> Lw.....	133
Squirrel, flying.....	19
ground	17
Merriam's	15
Minnesota red.....	138
northern flying.....	19
northern gray.....	15
southern red.....	16
western fox.....	16
Striped spermophile.....	18
Strong, R. M., lecture by.....	7
<i>Sylvivagus floridanus mearnsi</i> (Allen).....	25
<i>Synatomys cooperi</i> Baird.....	13
* <i>Syrphoctonus lavis</i> Brues.....	53
<i>Tamias striatus griseus</i> Mearns.....	17
<i>Taxidea taxus</i> (Schreber).....	28, 141
Tower, W. L., abstract of lecture by.....	130
Upham, Mrs. H. A. J., abstract of lecture by.....	132
<i>Urocyon cinereoargenteus ocythous</i> Bangs.....	25, 140
<i>Ursus americanus</i> Pallas.....	30
Variation, abstract of lecture on by W. L. Tower.....	130
Vole, Meadow.....	22
<i>Vulpes fulvus</i> (Desmarest).....	26, 140

Wapiti, Canadian.....	15, 137
Ward, H. L., on a bird new to Wisconsin.....	124
on melanism and albinism in a robin.....	43
on the American elk in southern Wisconsin.....	145
Wasps nests, remarks on.....	134
Wasps, lecture of habits of.....	3
Waters, lecture on.....	5
Weasel, alleghenian least.....	29
Bonaparte's	28
New York.....	29
Whitman, C. O., lecture by.....	6
Wild cat.....	25
Wisconsin mammals, preliminary list of.....	13
Wolf, gray.....	27
prairie	27
timber	27
Wolverine	141
Woodchuck	19
<i>Zapus hudsonicus</i> (Zimmermann).....	140
* <i>Zootrophes similis</i> Brues.....	52
<i>Zosterophyllum</i>	8, 11

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 6.

APRIL, 1908

Nos. 1 and 2

PROCEEDINGS.

Milwaukee, Oct. 10, 1907.

Meeting of the combined Sections.

President Teller in the chair and Mrs. Ruemmelin, Messrs. Brues, Colles, Edwards, Finger, Graenicher, Landau, Monroe, Russel and Ward present.

Mr. Colles exhibited some rocks and minerals from northern Ontario. Among them was a fine specimen of dentritic silver, probably deposited from solution: some cobalt bloom and some glaciated slate.

Mr. Monroe exhibited specimens of asters collected in September in the East. These included the following forms: *Aster divaricatus* L., and varieties; *A. Claytoni* Burg., *A. undulatus* L. and variety; *A. patens* L., and *A. acuminatus* Michx.?, all from western Massachusetts and Connecticut; *A. ericoides* L., from Western Connecticut, and *A. ericoides pilosus* (Willd) from northern Ohio. He also exhibited in connection with last two, specimens of *A. Faxonii* Porter, and *A. Pringlei* Gray; the former from northeastern Illinois, the latter from central Wisconsin. Mr. Monroe knew of no reason why the species above named should not all occur in Wisconsin, but he had never found the New England species in this State.

The members were very much interested in Mr. Monroe's exhibition, and there was a considerable amount of discussion concerning certain species.

The meeting then adjourned.

Milwaukee, Oct. 24, 1907.

Regular monthly meeting of the Society.

Vice-President Ward in the chair and 47 persons present.

The names of:

Mr. Charles B. Weil, 286 Knapp Street,

Dr. Geo. W. C. Meyer, Oconomowoc, Wis.,

Albert W. Martin, Jr., 3107 State Street and

Miss Alice Childs, East Side High School,

were proposed for active membership in the Society and they were elected at the directors' meeting following.

There being no further business, Mr. Howland Russel addressed the meeting on "A Visit to Linnaeus, a retrospection on the life, home and character of the great pioneer naturalist, gleaned from the writings of his contemporaries."

Mr. Russel gave a brief description of the personality of Linnaeus, followed by a biography considering the more important epochs in his life, with his achievements during each. At the close he pointed out the immense amount of work accomplished by Linnaeus and its place as the basis of all present systematic botany and zoology.

After some discussion on the part of various members, the meeting adjourned.

Milwaukee, Nov. 14, 1907.

Meeting of the combined Sections.

President Teller in the chair and about fifty persons present.

Mr. Colles spoke on "The Origin and Deposition of the Principal Ores of Copper and its Extraction."

The speaker described the most important ores of copper, and classified them according to their chemical constitution. He described the manner in which ores are deposited, more particularly their relation to watery solutions, their geographical distributions and abundance. He also described the methods of extracting the metal from several of the more important types of ores. After he had finished, several of the members joined in a short discussion on certain points.

Mr. Brues then exhibited a series of plants collected by the Museum expedition into northern Wisconsin during the past summer. He also showed a number of lantern slides illustrating the general aspect of the localities examined by the expedition.

The meeting then adjourned.

Milwaukee, Nov. 21, 1907.

Regular monthly meeting of the Society.

President Teller in the chair and about sixty persons present.

Dr. Geo. W. Peckham spoke on "Recent Additions to Our Knowledge of the Habits of Wasps." The speaker described the wonderful stinging instincts of certain wasps and then showed the advancing steps in the evolution of such instincts as illustrated by living species in different families.

He was followed by Dr. S. Graenicher, who discussed the habits of bees from the standpoint of recent discoveries. He dealt particularly with the locality and direction senses so frequently attributed to certain Hymenoptera. The recent concensus of opinion seems to be that these instincts are largely built upon individual experience and visual memory of objects, whose position has to be learned by the bees.

The meeting then adjourned.

Milwaukee, Dec. 12, 1907.

Meeting of the combined Sections.

President Teller in the chair and twelve members present.

The minutes of the last Section meeting were read and approved.

Dr. S. Graenicher spoke on "Adaptational Structures in Flower-Visiting Coleoptera." He referred briefly to the great range of variation among the different orders of insects with reference to the extent to which some of their members are adapted to obtain nectar from flowers. He described in detail the elongation of the anterior parts of the body in the genus *Leptura* and its allies and showed how these were adaptations to visiting flowers, their extent being correlated with the habits of the different genera. He also exhibited a number of meloid beetles belonging to the genus *Nemognatha* and showed how their variously elongated mouthparts adapted them to different flowers. The group is of neotropical distribution, but a single species occurs as far north as Milwaukee, where it frequents the flowers of *Rudbeckia*, which has a tube length exactly equal to the length of the beetle's mouthparts.

Questioned by Dr. Graenicher, Mr. Brues stated that he had collected one of the Texan species of *Nemognatha* on the flowers of another composite plant belonging to the genus *Gaillardia*.

After some further discussion on the part of Mr. Mann and others the meeting adjourned.

Milwaukee, Dec. 26, 1907.

Regular monthly meeting of the Society.

President Teller in the chair and about fifty persons present.

The minutes of the last regular monthly meeting were read and approved.

The following persons were proposed for membership in the Society, and subsequently elected by the Board of Directors:

Mr. L. F. Crosby, 2406 Wells Street, proposed by Mr. Ward.

Dr. A. W. Akerly, National Soldiers' Home, and Wm. C. Klann, 2816 Chestnut Street, by Dr. Barth.

There being no further business, Miss Alice Dufour addressed the Society on "Guatemala, the Country and Its People." Miss Dufour described the character of the people, their customs,—some of them relics of the Sixteenth century—their progress in fine arts and literature, making especial reference to their love for lyric poetry and their skill in wood carving. Their industries are few, although their immense resources are very great and offer an opportunity for American enterprise. At present most of their imports come from Germany. Among internal improvements the speaker described their street car system, telegraph, telephone and electrical lighting plants. At present there are five railroads in Guatemala, the trans-continental line being the most important and one destined to play a part in the future partition of Central America.

Miss Dufour also mentioned the various enlightening forces at present active in the country, referring especially to the schools, one of which, the government school for girl's, had been in her own charge while she was in Guatemala.

The lecture was illustrated by a large series of stereopticon slides.

After expressing to Miss Dufour the thanks and appreciation of the Society, President Teller declared the meeting adjourned.

Milwaukee, Jan. 9, 1908.

Meeting of the combined Sections.

President Teller in the chair and about forty members present.

The minutes of the last section meeting were read and approved.

There being no further business, Mr. Wm. Segall spoke on, "Waters; Pure, Impure and Mineral." The speaker gave some facts concerning the general properties and distribution of water on the earth, its importance to life and other activities of matter. He also treated the question from the standpoint of drinking water, sanitation, etc., concluding with a consideration of some of the more important types of mineral waters.

Following this, Mr. H. L. Ward and C. T. Brues made some remarks concerning the recent Chicago meeting of the American Association for the Advancement of Science. They described the various activities of the numerous sections and affiliated societies and indicated the trend of work along different lines as exemplifying the present attitude of scientific research in particular fields.

The meeting then adjourned.

Milwaukee, Jan. 30, 1908.

Regular monthly meeting of the Society.

Vice-President Ward in the chair and about eighty persons present.

The names of:

Dr. Arthur J. Burgess, 1102 Grand Avenue,

Albert P. Puelicher, 137-139 Wisconsin Street, and

Dr. Patrick H. McGovern, 2036 Grand Avenue,

were proposed for active membership, and those of Miss Florence Buck and Miss Marion Murdock, for corresponding membership in the Society. These were later elected by the Board of Directors.

Mr. Charles E. Akeley of the Field Museum, Chicago, gave an account of his journey to, and a stay of fourteen months among the natives and wild animals of East Equatorial Africa; with experiences in the lion infested game fields of Athi Plains, the home of the Buffalo and Rhinoceros in trans-tana country, and with elephants in the forests and bamboo jungles of snow-capped Mount Kenya.

Mr. Akeley's lecture was illustrated by a large series of excellent lantern slides made from negatives which he had made in Africa.

After he had finished, Mr. Ward expressed the thanks of the Society for the unusual opportunity given by Mr. Akeley of hearing at first hand of this remarkable part of the African continent.

The meeting then adjourned.

Milwaukee, Feb. 13, 1908.

There was no special section meeting of the Society, as the Natural History Society met in conjunction with the Wisconsin Academy of Sciences, Arts and Letters, the Wisconsin Archeological Society and the Wisconsin Mycological Society, in a general meeting at the Public Museum, on the evening usually devoted to the section meeting.

Milwaukee, Feb. 27, 1908.

Regular monthly meeting of the Society.

President Teller in the chair and about fifty persons present.

The names of:

Gustav J. A. Trostel, 555 Terrace Avenue,
G. Fred Bossert, 719 Franklin Place,
Dr. A. Ivans Comfort, National Soldiers' Home,
Geo. A. West, 97 Wisconsin Street, and
Alfred Cummings Burrill, Public Museum,

were proposed for membership and subsequently elected by the Board of Directors.

There being no further business, President Teller introduced Prof. C. O. Whitman of the University of Chicago, who spoke on "The Problem of Progressive Evolutions as Elucidated in the Color Patterns of Pigeons."

Prof. Whitman dealt principally with the possibilities of applying Mendelian principles to the changes in color produced by the hybridization of various kinds of pigeons.

The results obtained by him after very extensive breeding and crossing seemed to show that Mendel's law is not applicable to the inheritance of color patterns in pigeons. A number of colored figures of parent pigeons and their hybrid offspring were exhibited and the differences between the actual and expected Mendelian results pointed out. The speaker also exhibited a number of colored drawings which showed the apparent determinate trend of evolution of color patterns in certain pigeons.

After thanking Prof. Whitman on behalf of the Society, President Teller declared the meeting adjourned.

Milwaukee, March 12, 1908.

Meeting of the combined Sections.

President Teller in the chair and fourteen members present.

The minutes of the last meeting were omitted on account of the

fact that the Society had not held its last meeting individually, having met in combined session with the Wisconsin Academy of Arts, Sciences and Letters, and with other scientific societies.

Mr. Colles exhibited some rocks and fossils from Yellowstone Park and made some remarks concerning the general geological features of the region.

Mr. Burrill called the attention of the members to the spruce gall-louse and asked concerning the occurrence of spruce trees in this vicinity. Several members took part in the discussion which followed. Mr. Burrill spoke of the interest which attaches to the distribution of these insects and the members agreed to look for their occurrence in our locality.

Mr. Doerflinger called attention to certain prehistoric artifacts from France and Switzerland and the persistence of some types of manufacture very similar among primitive sections in France at the present day. The preservation of these wooden articles led to a discussion of the question as to how long wood could be preserved under natural conditions, particularly under water. After some discussion, the topic turned to the formation and preservation of deposits of peat and the way in which the size of these deposits could be utilized in measuring time, particularly the time between glacial epochs in the Northern Hemisphere.

The meeting then adjourned.

Milwaukee, March 26, 1908.

Regular monthly meeting of the Society.

President Teller in the chair and fifty persons present.

The minutes of the last regular monthly meeting were read and approved.

The name of Rev. Judson Titsworth, 216 Martin Street, Milwaukee, was proposed for active membership in the Society and he was later elected by the Board of Directors.

There being no further business, President Teller introduced Dr. Strong, of the University of Chicago, who spoke on "The Brooding Habit in Birds," a discussion of the evolution of the brooding instinct in animals and its occurrence in various groups.

Dr. Strong's lecture was illustrated by a large series of slides made from original photographs.

At the close of the lecture, President Teller expressed the thanks of the Society to the speaker, after which the meeting adjourned.

SOME FOSSIL PLANTS FROM THE MIDDLE DEVON- IAN OF MILWAUKEE, WISCONSIN.

BY D. P. PENHALLOW, D. SC., F. G. S. A.

On the 26th of January of the present year, I received from Prof. H. F. Cleland of Williams College, two photographs of specimens from the Hamilton Group at Milwaukee, Wisconsin. These were designated as being in all probability, a species of *Nematophycus* which had already been found in the Hamilton Group of New York, and a plant possibly related to *Zosterophyllum* from the Old Red Sandstones of Scotland.

Subsequently, the Director of the Milwaukee Museum, Mr. Henry L. Ward, to which institution the specimens belonged, forwarded the material for more thorough examination. From a critical study of these remains it has been possible to obtain more reliable data as now embodied in these notes, and to draw therefrom certain tentative conclusions as a basis for further study.

The specimens were designated as Nos. 1 and 2, and no details accompanied them beyond the simple statement that they were from the Hamilton Group of Milwaukee, Wisconsin.

***Nematophycus milwaukeeensis* n. sp. (Plate I.)**

The specimen No. 1, carrying the museum number 402, and designated as having been collected by C. E. Monroe, from the Hamilton Group of Berthelet, Milwaukee County, Wisconsin, measures 68 cm. in extreme length. It has been broken into three fragments, but when in place, these show a continuous stem. The upper end has a width of 5.5 cm., and a maximum thickness of 1.7 cm. These dimensions are maintained for a distance of 41 cm. when the stem expands, at first gradually and then somewhat rapidly, into a rather large base 12 cm. broad and 3.8 cm. thick.

These dimensions, however, probably do not represent the real base of the plant, since there is no evidence of a root system or of holdfasts. There is no evidence of branching at any part of the stem, although on the central fragment, on the side opposite that shown in the photograph, there is an apparent knot suggestive of a projecting organ of some sort. On closer examination, however, it is seen that this feature is completely covered by a prominent layer of coal derived from the carbonization of the superficial parts of the stem. Whatever its character may be, it is, therefore, clearly related to the interior structure and not to the surface parts.

The specimen shows several transverse joints. These are in no sense structural, but have been caused by displacement in the matrix and were subsequently filled with silica. Such joints are well known features of *Nematophycus*. Apart from them, there is no evidence of nodes, from which it may be concluded that the stem was of a very simple character such as may be met with in the stipes of the *Laminariæ*.

The interior of the specimen has been entirely occupied by silica which has so completely replaced all structure that no evidence of the nature of the plant from that source could be obtained. The only basis from which information could be secured, was found in the general form of the specimen and the occurrence of a very prominent layer of coal which originally extended over the entire surface, but which, owing to its very friable character, has been very largely removed. The side of the specimen shown in the photograph, indicates the almost complete removal of this layer, but on the opposite side it covers nearly half the specimen. The coaly layer has a maximum thickness of 2 mm., and gives abundant evidence of the former presence of plant structure.

In endeavoring to determine the possible nature of the plant represented, it may be recalled that there are only two genera of

plants from so low a horizon, with which it may be compared—*Cordaïtes* and *Nematophycus*.

With respect to the former, although at least four species are known to the Middle Devonian¹, there are none which may be directly compared with the present specimen, either in external appearance or in mode of preservation, and it is permissible to exclude the genus from further consideration, without hesitation.

Nematophycus crassus is known to the Hamilton Group of New York². So far as the general mode of preservation may be taken as evidence, that presented by the Berthelet specimen is in exact accord with what is commonly found. Furthermore, the condition in which the plant is found, indicates clearly, that it was soft in texture and very susceptible to decay which had progressed extensively before infiltration.

The absence of hapteres and other portions of the anchorage system, cannot be adduced as evidence opposed to the view that this may have been a large alga, since such an objection would be equally valid as applied to *Cordaïtes*. All the evidence points with directness and force, to the idea that the plant is a species of *Nematophycus*, but which of the known species it is impossible to determine in the absence of internal structure.

So far as known, *N. crassus* is the only species found in the Hamilton Group, and it must have had a very extensive distribution in Middle Devonian time. It is, therefore, in a high degree probable that the New York specimens and those from Milwaukee represent the same species. It would seem better, however, to indicate the latter by a distinctive name derived from the locality, until such time as further and more complete material may enable

¹ North American Species of *Dadoxylon*. Trans. R. S. C., VI, 1900, iv, 51-97.

² Ann. Bot., X, 1896, 47.

Proc. U. S. Nat. Mus., 929, 1893, 115-118.

Trans. R. S. C., VII, iv, 23.

us to determine its relation to known species in a more thorough and satisfactory manner. I therefore call it *Nematophycus milwaukeeensis*.

***Fucus bertheletensis* n. sp. (Plate II.)**

Specimen No. 2, bearing the museum number 399, presents the form of several strap-shaped organs lying in parallel positions, and representing probably, the subdivisions of one plant. When first examined by means of a photograph, showing the plant on a reduced scale, it was believed to be comparable with *Zosterophyllum myretonianum*, Penn.¹, from the Devonian of Scotland, but a later study of the actual specimen showed that such a comparison is in no sense justified.

As shown by the photograph, the plant is represented by a series of 16 linear members projected in a parallel manner. In three separate places it may be seen that the members subdivide by a regular dichotomy, and the conclusion is justified that such dichotomy is characteristic of the plant as a whole.

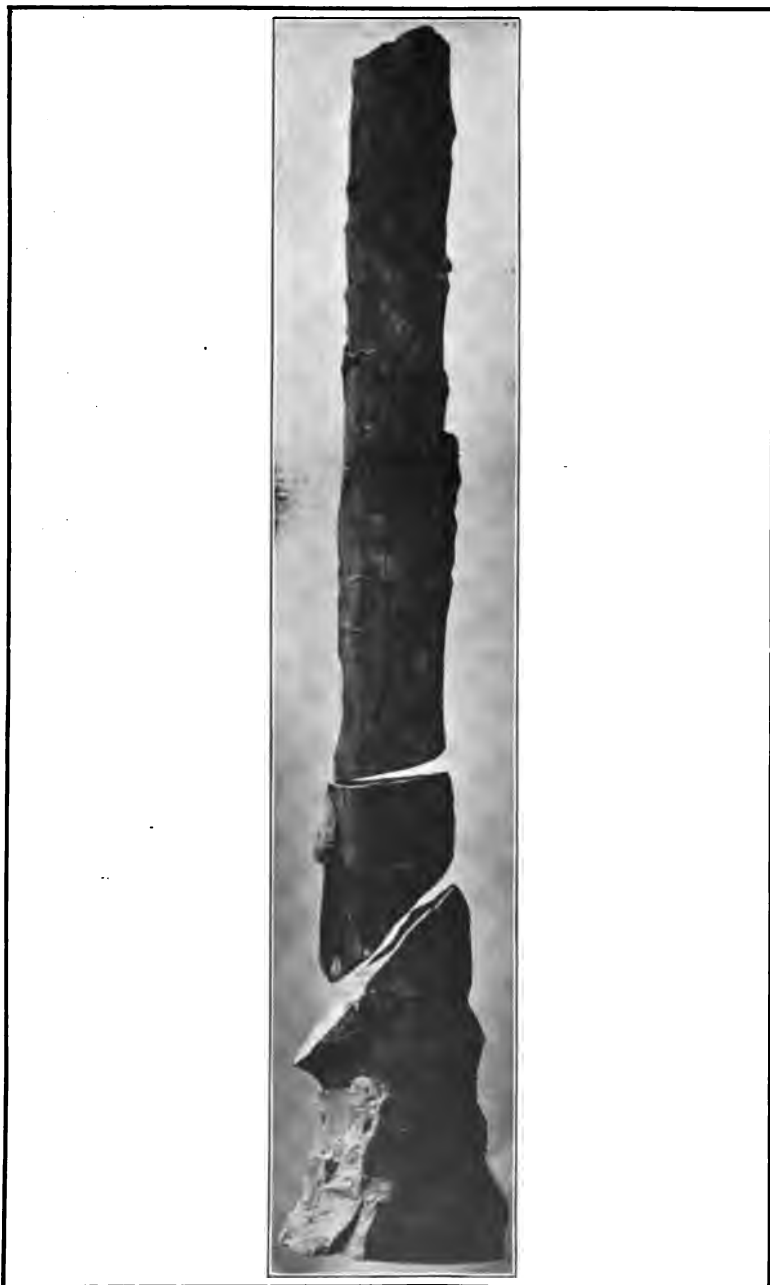
The plant has been carbonized, but instead of a very thin filmy layer of carbon as would be obtained from plants of the type of *Zostera*, the deposit is somewhat bulky, and, indeed, represents the entire structure. The organs are obviously thicker in the middle where there is evidence of a structure comparable with a midrib as presented by the medullary region of many of the Phæophyceæ. Individually, the various members are linear, 4-7 mm. broad and distinctly dichotomous, the largest fragments showing simple branches 18 cm. in length.

From these facts it is evident that the plant must have been possessed of rather thick and bulky parts, the structure of which was not only susceptible of somewhat ready decay, but which was entirely carbonized. Like *Nematophycus*, it was evidently of an aquatic habit. All of these considerations point with some force

¹ Can. Rec. Sc., 1892, 9.

to a comparison with rockweeds, the essential features of which it possesses in a large degree, although no fruit has been observed.

The genus *Fucus* is not on record for so low a horizon, but there is no valid reason why it should not be found in the Middle Devonian, as well as the laminariæ. I designate it as *Fucus bertheletensis*.



NEMATOPHYCUS MILWAUKEENSIS PENHALLOW.



FUCUS BERTHELETENSIS PENHALLOW.



A PRELIMINARY LIST OF WISCONSIN MAMMALS.

BY HARTLEY H. T. JACKSON.

The present list of the mammals of Wisconsin is chiefly a result of the author's personal investigations in the state, supplemented somewhat by the studies of other mammalogists. The author is fully aware of the incompleteness of this paper and looks forward to the time when the working mammalogists of Wisconsin will, together, publish a list which will fully describe the distribution, habitats, and life histories of the mammals of the state. The eastern half of the state has been quite well covered by field study but there is room for much careful work in the western and northwestern sections, especially along the Mississippi bottomlands, and in the region adjacent to Lake Superior.

No list of the mammals of Wisconsin has appeared since Moses Strong published his "List of the Mammals of Wisconsin", in the *Geology of Wisconsin* (Survey of 1873-1879), Volume I, Chapter X, pages 436 to 440. The list has served as a valuable guide to mammalogists, but many of Mr. Strong's records are not based upon actual examination of specimens, and are very doubtful. A few other papers of local and restricted character have been published.

Many species of mammals which have not yet been taken within the boundaries of the state may be expected in future collections. Particular effort has been made to secure specimens of *Microtus pinetorum scalopsoides* (Aud. & Bach.), *Synatomys cooperi* Baird, *Mephitis mesomelas avia* (Bangs.), *Putorius longicauda spadix* (Bangs), *Sorex fumeus* Miller, *Scalopus aquaticus machrinus* (Rafinesque), and others, whose geographical distribution it seems should include parts of Wisconsin. There are

certain other species which without doubt have occurred within the state in earlier days if they do not occur at the present time but of which we have no actual records; among these might be mentioned *Alces americanus* Jardine, *Bison bison* (Linnæus), *Felis concolor* Linnæus, *Gulo luscus* (Linnæus), and *Mustela pennanti* (Erxleben.)

There are two specimens of *Gulo luscus* in the Public Museum of the City of Milwaukee, labeled "Wisconsin", but as there are no other data we consider the record unsatisfactory. The writer has examined specimens from Wisconsin of all species recorded with the exception of *Sorex hoyi* Baird.

The author wishes to acknowledge his gratitude to all who have aided him in his studies of Wisconsin mammals. Acknowledgments are especially due to Dr. H. V. Ogden and to the officials of the Public Museum of the City of Milwaukee for the privilege of examining specimens in their respective collections; also to Dr. C. Hart Merriam, Mr. E. W. Nelson, Mr. Vernon Bailey, Mr. W. H. Osgood, and to others of the United States Biological Survey for identifying certain specimens and for substantiating identifications of many other specimens.

***Didelphis virginiana* Kerr.**

Opossum.

Didelphis virginiana is occasionally captured in the south central portion of the state. One was taken in Green County, January 24, 1902, and again in the autumn of 1906 two more were taken near the same locality. Mr. Moses Strong reported it as found occasionally in the vicinity of Lake Michigan (1); but this has not been our experience as we find no records for this region.

***Odocoileus americanus borealis* Miller.**

Northern Deer.

Deer are gradually diminishing in numbers wherever they are found. The cause of this decrease is not inefficient legislation, but

it is because of inefficient protection from wolves and law-breakers. Venison is the chief food of wolves during the winter months, and in the northern third of the state it is the principal meat of a large number of the rural population during the summer. With proper protection from these two evils, there is no reason why deer should materially decrease.

Deer are found rarely in the whole region west and north of the Wisconsin River, becoming gradually more plentiful towards the north. During very severe winters they occasionally wander to the southern tier of counties. East of the Wisconsin River they occur in Adams, Waushara and Outagamie Counties, thence northward.

***Cervus canadensis* (Erxleben.)**

American Elk; Wapiti.

The elk is without doubt now extinct in Wisconsin, but cast-off antlers scattered throughout the lakes, marshes and woods of northern Wisconsin attest of its former occurrence there. I have examined antlers of *Cervus canadensis* found in Ashland and Iron Counties.

***Sciurus carolinensis hypophæus* Merriam.**

Merriam's Squirrel.

The exact distribution of *Sciurus c. hypophæus* in the state has not yet been satisfactorily determined. In many localities it is quite common, being partial to heavy timber near water, often in company with *Sciurus c. leucotis*. It is found locally in a narrow rectangular stretch of country extending northwesterly from Racine and Waukesha Counties on the south to Dunn County on the north. This squirrel probably occurs in many other parts of the state but I know of no specimens taken outside of the area above described.

***Sciurus carolinensis leucotis* (Gapper).**

Northern Gray Squirrel.

The relative abundance of the gray squirrel seems to vary with the abundance of hickory nuts. In years when nuts are plentiful

gray squirrels are common, and at such times seem to outnumber the other squirrels; then for a period of years they will be scarce, only to return when there is a crop of their favorite food.

Gray squirrels are sociable little fellows and if unmolested will make their homes in trees in the streets and parks of cities. Several towns throughout the southern part of the state have squirrels running about the streets, most notable of which is Fort Atkinson; here, at times, six or eight may be seen playing together. The two forms *hypophæus* and *leucotis* both occur in Fort Atkinson; here, also, melanistic specimens were seen, the only black squirrels I have observed in southern Wisconsin.

Gray squirrels are reported from Forest County, but the most northern records I have are Adams and Dunn Counties.

***Sciurus hudsonicus loquax* Bangs.**

Southern Red Squirrel; Chickaree.

Red squirrels are apt to make their appearance in any section of the state where conditions favor their welfare, but their true home is the north where they dwell chiefly along the streams, lakes and swamps at the edge of the woods. Chickarees prefer hemlock groves, but are not averse to mixed woods of pine, cedar, larch or birch. When they occur in the southern part of the state they are usually found in larch swamps or groves of bur oak. Red squirrels are erratic in occurrence, but not to such an extent as gray squirrels. They do not hesitate to swim across rivers, and I have frequently seen them swim through rapids which would baffle many aquatic animals. On one occasion I saw a red squirrel in North Pelican Lake swimming from one point of land to another fully ninety rods distant, and so skillful was he in his efforts that at a distance I mistook him for a mink.

***Sciurus niger rufiventer* Geoffrey.**

Western Fox Squirrel.

Fox squirrels are not as abundant as formerly; even the past ten years have shown a decrease in their numbers in all the sections

of the state where they are to be found. It is reported by reliable authorities that in the days of the early settlers fox squirrels were so plentiful as to be a nuisance and that often in the autumn twelve or fifteen could be seen at one time carrying corn from the field to the woodland. They are at present regularly distributed over the southern half of the state, being more common in the central portion of this area and becoming less common along the shore of Lake Michigan and in the southern tier of counties.

***Tamias striatus griseus* Mearns.**

Gray Chipmunk; Ground Squirrel.

Tamias s. griseus is found from the southern boundary of the state north at least to Oneida County, where I took an adult female August 20, 1907. This specimen was taken in a clearing among birch trees, and specimens of *Eutamias q. neglectus* were trapped in the same clearing. Old rail fences and second growth woods are the favorite habitats of the gray chipmunk and in such environments it is quite common north to about latitude 45°.

Chipmunks are particularly fond of berries, and during the month of July gooseberries and raspberries constitute their chief food; seeds of the linden tree also find favor in their eyes, and the smaller grains and grass seeds receive their due amount of attention.

***Eutamias quadrivittatus neglectus* (Allen).**

Little Striped Chipmunk.

This, the eastern representative of the Rocky Mountain chipmunk, is confined in Wisconsin to the Canadian zone; here it lives in open woods and clearings. In the northern part of its range it confines itself almost entirely to rock piles, but in the southern part of its range it inhabits sand banks, stump piles, brush heaps, and nearly any conceivable location except dense woodlands and swamps.

No sooner is the camp made than these little chipmunks make

their appearance. At our camp on North Pelican Lake in the summer of 1906 no chipmunks were visible when we landed our boat-load of supplies, but within a few days they were present in dozens. They must investigate everything and one even entered my suitcase, left partly open, and remained there for several minutes. When we broke camp two of them entered the loaded boat. After the boat was launched they jumped into the water, though with considerable hesitation, and swam ashore.

***Citellus franklini* (Sabine).**

Franklin's *Spermophile*; Gray Gopher.

Gray gophers are generally considered rare in all sections of the state but careful observation will prove them quite common west from Rock County to the Mississippi River and north to Pepin County. I have taken specimens in Rock County, and have observed the species in Green, Sauk and Jefferson Counties.

The habit Franklin's gopher has of dwelling in fields of growing grain and along old fence lines keeps the species in obscurity. As soon as the grain is cut in the fields this species takes up its abode in the taller grass along fences and in old pastures. It is a very shy mammal, and unless great caution is used it cannot be approached closely. These characteristics, together with its protective coloration, make it one of our most difficult rodents to study.

***Citellus tridecemlineatus* (Mitchell).**

Striped *Spermophile*; Gopher.

This is one of our few Wisconsin mammals which has increased in numbers. There is scarcely a meadow, pasture, or roadside in the southern half of the state but what has its colony of gophers. Early in April or late in March they begin to awaken from their hibernation, and with the warm weather of May they commence their whistling which continues until the frosts of October drive them to their burrows for another winter. The latest

I have observed them out of their burrows in the autumn was November 1, 1903, at Milton.

***Marmota monax* (Linnæus).**

Woodchuck; Ground Hog.

Marmota monax probably occurs over the whole of Wisconsin in favorable localities; it is most abundant in the southern counties and appears to be quite common as far north as Barron and Langlade Counties. It undoubtedly will be found less abundantly northward to Lake Superior, but we have seen no specimens from that region.

***Sciuropterus sabrinus* (Shaw).**

Northern Flying Squirrel.

The large northern flying squirrel is found in the extreme northern counties of the State. It is probably not uncommon in favorable localities but it is seldom observed on account of its nocturnal habits. Specimens have been examined from Iron and Price Counties.

***Sciuropterus volans* (Linnæus).**

Flying Squirrel.

The southern form of *Sciuropterus* is found wherever there is suitable hardwood timber in the state. During the day it remains concealed in a nest composed of grass, moss, plant down and fur, which is generally situated in a small cavity in an oak or poplar; cavities made by woodpeckers are preferred but sometimes natural cavities are chosen. Flying squirrels are nocturnal in habits and are seldom observed; however, a few sharp raps with a stick upon the trunk of the tree will usually bring them from their nest cavities if they are at home.

***Castor canadensis* Kuhl.**

American Beaver.

Beavers at one time were not uncommon along many of the streams in northern Wisconsin; remnants of beaver dams and

lodges are quite frequently encountered, and some of them appear to have been quite recently built. There are a few beavers still remaining in some of the more secluded portions of the state, and it is hoped that sufficient protection will be given them to prevent their extermination.

There are two skulls of *Castor canadensis* in the collection of Dr. H. V. Ogden; one of these was taken in Sawyer County, November 3, 1899; the other was taken in Iron County, October 8, 1903.

***Mus musculus* Linnaeus.**
House Mouse.

House mice are common around dwellings and barns over the entire state. In the southern part of the state they are found in nearly every cornfield and grassy meadow, and I caught two specimens in traps set for shrews in a wet marsh. Apparently not increasing in abundance.

***Mus norvegicus* Erxleben.**
Brown Rat.

This mammal is too well known to need discussion. Rats are found everywhere in the state, but are less abundant in the northern sections. I have observed them in the cornfields in Rock County; this is the only locality where I have found them any distance from buildings. Mr. J. N. Clark reports them occurring "to some extent in fields in summer and fall" in Dunn County.

***Peromyscus canadensis* (Miller).**
Canadian Deer Mouse.

My specimens of *Peromyscus* from the pine regions of northern Wisconsin have been determined by Mr. W. H. Osgood to be *canadensis* and not the sub-species *umbrinus*. All the specimens that I have taken average slightly smaller than typical *canadensis* and in this respect approach *umbrinus*, but their color compares favorably with *canadensis*. Average measurements of three

males; Total length 151 mm.; tail vertebrae 67.3 mm.; hind foot 20.5 mm.; Average measurements of three females: Total length 174 mm.; tail vertebrae 91.6 mm.; hind foot 21 mm.

I have always found the Canadian white-footed mouse most abundant among alder (*Alnus*) bushes near pine forests, and particularly along gently sloping lake shores. Like other members of the genus they are nocturnal, and shortly after dusk they come from their holes to hunt for food. While sitting by the camp fire one evening I heard some mice not twenty-five feet from me. I baited a trap with walnut meat and set it among the alders; I reset it twice, and in less than twenty minutes I had taken three adult *Peromyscus canadensis*.

***Peromyscus leucopus noveboracensis* (Fischer).**

Woodland Deer Mouse.

Peromyscus l. noveboracensis is quite abundant in deciduous woods, being apparently more abundant in the southeastern part of the state than elsewhere. Whether its range overlaps that of *P. canadensis* has not yet been determined.

***Peromyscus michiganensis* (Aud. & Bach).**

Michigan Deer Mouse.

Peromyscus michiganensis is conspicuously absent in the vicinity of Lake Michigan, but in Walworth, Jefferson and Dodge Counties, and west to the Mississippi River it is quite abundant. Our knowledge of the northern extension of its range is not satisfactory.

The Michigan white-footed mouse inhabits the prairie regions, where it may be found in grassy meadows, in patches of weeds, or along old fences; occasionally it takes its abode in second growth timber and in brushwood. In the autumn this species frequently dwells in corn shocks in company with *Microtus ochrogaster*, and if undisturbed will remain there to rear its young the following spring. The young of *Peromyscus michiganensis* are

dark slate color dorsally, much different from adult specimens, and were formerly mistaken for a distant species, *Peromomyscuscus bairdii* (Hoy & Kennicott).

***Evotomys gapperi* (Vigors).**

Red-backed Mouse.

This is the mouse frequently found in pine regions along the steep banks of streams and lakes and in sphagnum bogs and marshes; on a few occasions in Oneida County I have seen this species in hayfields, and one I saw in a deserted lumber camp. *Evotomys gapperi* is taken occasionally in southern Wisconsin along Lake Michigan, but in the interior of the state it is rarely seen south of Columbia County. The species is dichromatic, there being the ordinary red phase, and the brown phase. I have never seen specimens from Wisconsin in the brown pelage; Mr. Gerrit S. Miller reports such specimens from the north shore of Lake Superior (2).

***Microtus pennsylvanicus* (Ord).**

Meadow Mouse; Meadow Vole.

This species occurs over the whole state in suitable locations. It is found principally in wet meadows, in hayfields and in cornfields, but it sometimes inhabits open woods and marshes. In the autumn *Microtus pennsylvanicus* leaves the lower lands for the sides of grassy hills; after the first snow falls it builds nests and makes runways on the surface of the ground beneath the snow, seeming to prefer the deeper snow and drifts for this purpose. When the snow melts in the spring, the majority of the animals again migrate to the lower lands, where they dwell during the summer months.

Meadow voles are quite diurnal in habits and may be seen frequently scampering through their runways at mid-day; more especially is this noticeable in the early spring.

I have known the species to become a pest in a house, but such cases are rare.

Microtus ochrogaster* (Wagner).*Prairie Meadow Mouse.**

Microtus ochrogaster is not so generally distributed as *Microtus pennsylvanicus*; our present knowledge limits its distribution in the state to the extreme southern and western counties, where it is locally common in upland grassy meadows and corn-fields.

This species is often mistaken for the more common *Microtus pennsylvanicus*; in summer pelage the species are very similar, and a study of cranial characteristics is generally necessary; in winter pelage adult specimens of *ochrogaster* can always be distinguished from *pennsylvanicus* by the cinnamon color of the ventral portions of the former. Immature specimens are more difficult to determine.

Fiber zibethicus* (Linnæus).*Muskrat.**

Muskrats are distributed over the entire state wherever there are streams with clay or loam banks, and, more abundantly, around the lakes and the open swamps and marshes. The familiar muskrat houses are much more common in the southern part of the state than in the northern regions, but this does not necessarily indicate that the species is less plentiful in the northern sections; where sedge, rushes and flags are found the animals usually build houses in which to dwell, but where vegetation is lacking muskrats make their homes in holes in the banks of streams and lakes. It is generally believed that the large houses are used for winter headquarters, but from my own observations, and from what I can learn from old trappers, I am inclined to believe that these are chiefly summer houses, the smaller mud or sod houses being used for winter homes.

***Zapus hudsonius* (Zimmermann).**

Jumping Mouse.

Zapus hudsonius occurs locally in many parts of the state, but it is nowhere common. The species appears to be most frequently found along creeks and brooks in the northern parts of the state; meadows and hayfields are haunts of this species in southern Wisconsin. I have taken only one specimen in the state; that one was taken August 9, 1907, near Crescent Lake in Oneida County.

***Erethizon dorsatum* (Linnæus).**

Canadian Porcupine.

The porcupine is another of our mammals which is unable to withstand the approach of civilization, and as fast as the coniferous forests are cut away and the spruce and cedar swamps drained and cleared, this species disappears. It was formerly common in all the northern woods, but it is now becoming rare except in the wild and unsettled portions.

***Geomys bursarius* (Shaw).**

Pocket Gopher.

Pocket gophers are common in some localities in the western part of the state near the Mississippi River, but we have no specimens or records from extreme southern Wisconsin. We have had frequent reports of pocket gophers but investigation has always proven the animal reported to be some other species. I have reliable reports of the occurrence of *Geomys bursarius* in Pepin and Pierce Counties; in the latter county it is reported quite common in some localities. Dr. C. Hart Merriam reports the species from Winnebago and Fond du Lac (3), and includes southern Wisconsin within its geographical range (4). The only specimen I have is a young male taken by Mr. J. N. Clark, October 21, 1901 at Meridian, Dunn County. Mr. Clark writes that pocket gophers are "common in sandy soil" in Dunn County.

Lepus americanus phænotus Allen.

Minnesota Varying Hare.

Varying hares are not uncommon in most sections of northern Wisconsin, but owing to their retiring habits and to their excellent protective coloration they are not often seen. *Lepus americanus phænotus* usually prefers to inhabit thin woods and brushland though occasionally it is found in the forests; during the day it remains hidden in the undergrowth, but early in the morning and in the evening it comes out into the old lumber roads and trails to nibble the green vegetation.

Five adult specimens, two males and three females, taken near Rhinelander, average as follows: Total length 457.4 mm.; tail vertebrae 40.8 mm.; hind foot 134.1 mm.

Sylvilagus floridanus mearnsi (Allen).

Prairie Cotton-tail Rabbit.

The familiar cotton-tail rabbit is found over the southern half of the state north at least to Dunn and Outagamie Counties; it probably occurs farther north in the state, but more specimens and data are needed before the exact distribution of the species is known.

Lynx canadensis Kerr.

Canadian Lynx.

Lynx canadensis is taken occasionally in most of the northern counties but it is outnumbered in all localities by *Lynx ruffus*. I have examined specimens of *Lynx canadensis*, either skins or skulls, taken in Ashland, Bayfield, Iron, Oneida and Price Counties.

Lynx ruffus (Güldenstædt).

Wild Cat.

The wild cat, bob cat, bay lynx or catamount as it is variously called is comparatively common in the unsettled portions of northern and central Wisconsin, and specimens are occasionally taken

County. Specimens taken in Bayfield and Oneida Counties have also been examined.

***Mephitis hudsonica* (Richardson).**

Northern Plains Skunk.

We have examined specimens of *Mephitis*, mostly skulls, from various parts of the state, and all have proven to be *hudsonica*. The species seems to be quite common in all parts of the state.

***Taxidea taxus* (Schreber).**

American Badger.

The badger is found regularly in the sandy regions of the northern part of the state, but southward it becomes more uncommon. During the eighteen months from August, 1900 until February, 1902, badgers were quite common in certain sections of Rock County; between these two dates there were nine badgers captured within a radius of eight miles of Milton; one was shot in August, 1900, within the village limits. June 13, 1902, I obtained an adult male four miles east of Milton; this specimen weighed twenty-three pounds and six ounces, and measured as follows: Total length, 764.5 mm.; tail vertebrae, 131.8 mm.; hind foot, 103.4 mm.

***Putorius vison* (Schreber).**

Northern Mink.

Putorius vison is found throughout the state wherever there are suitable streams, lakes or marshes; the species is quite common in nearly all sections, but it appears to be most abundant in the central parts of the state.

***Putorius cicognanii* (Bonaparte).**

Bonaparte's Weasel.

Bonaparte's Weasel is taken occasionally in all parts of the state with the possible exception of the extreme southwest portion; it is most abundant in northern Wisconsin and in eastern

Wisconsin near Lake Michigan; in these parts of the state it outnumbers *Putorius noveboracensis*.

***Putorius rixosus allegheniensis* (Rhoads).**

Alleghenian Least Weasel.

The single specimen of this rare weasel which has been taken within our boundaries has already been recorded by Mr. Henry L. Ward, (6); this specimen was taken November 26, 1906, near Burlington, Racine County. Specimens of typical *rixosus* have been taken in Minnesota, and additional collections and study may prove the two forms, *rixosus* and *allegheniensis*, to intergrade in central or northern Wisconsin.

***Putorius noveboracensis* Emmons.**

New York Weasel.

Putorius noveboracensis is the most common weasel in the southern and central parts of the state, westward to the Mississippi River; eastward, in the vicinity of Lake Michigan it does not appear to be so common.

***Mustela americana* Turton.**

Pine Marten; American Sable.

The pine marten is now practically extinct in Wisconsin. I have seen only three specimens which have been taken in the state; one of these, a trapper's pelt, was taken in Vilas County in the winter of 1904-1905. Dr. H. V. Ogden has two skulls in his collection; one taken at Fisher Lake in Iron County from an animal killed in December, 1897; the other was taken near Drummond in Bayfield County.

***Procyon lotor* (Linnæus).**

Raccoon.

Procyon lotor is distributed over the entire state, but it is most abundant in the western part; in the northern pine regions it becomes less common. Raccoons prefer oak woods in the vicinity

of lakes and rivers; here they may dwell in hollow trees or logs, but frequently they inhabit deserted buildings. Four were taken at one time from the loft of a deserted log house near Johnstown, Rock County. Two specimens examined, from Forest County, are abnormally dark.

***Ursus americanus* Pallas.**

Black Bear.

Ten years ago the black bear was not uncommon in nearly all parts of northern Wisconsin, but it is now seldom taken except in the counties north and west of Oneida County; in the latter county it was quite common until about eight years ago. A few are still found in Forest County.

***Sorex personatus* I. Geoffrey.**

Masked Shrew.

This little shrew has been taken in most parts of the state except in the southwestern portion, and careful collecting may possibly prove its presence there. It is not common in the southern half of the state, though of regular occurrence; in northern Wisconsin I found it very common, and I have taken specimens in wet swamps, on dry hillsides, along railroad tracks, and in fact, in almost every conceivable habitat except the dense pine forests. The species is evidently most abundant in sphagnum swamps and in grassy, second growth woodlands.

***Sorex richardsonii* Bachman.**

Richardson's Shrew.

The only knowledge I have of the distribution of *Sorex richardsonii* in Wisconsin is based upon five specimens, two males and three females, taken in Oneida County; one of these specimens was taken August 25, 1906; the other four were taken during the summer of 1907. All of these were taken in a swamp overgrown with small conifers (*Larix*, *Picea* and *Juniperus*) just southeast

of Rhinelander. Average measurements of two males: Total length, 116 mm.; tail vertebrae, 39.5 mm.; hind foot, 14 mm.; Average measurements of three females: Total length, 114.5 mm.; tail vertebrae, 38 mm.; hind foot, 13.2 mm.

Sorex hoyi Baird.

Hoy's Shrew.

Baird's type of *Sorex hoyi* was a male collected at Racine, Wisconsin (7); two males, including the type, are recorded by Professor Baird from that locality (8). There is a shrew in the Milwaukee Public Museum collected in 1879 by Thure Kumlien in Jefferson County; this specimen, a female, bears the label *hoyi*, but I have been unable to examine it critically, and, being mounted with the skull inside, the species has not been positively determined by the author.

Neosorex palustris (Richardson). (Plate III.)

Marsh Shrew.

I secured four specimens of *Neosorex palustris* near Rhinelander in the swamp where I caught *Sorex richardsonii*. The four *Neosorex* were all trapped in the same runway, and, though the trap was in the runway over two weeks, no other species were captured there. The runway entered a mass of sphagnum which surrounded the roots of swamp laurel (*Kalmia glauca*); within the sphagnum beneath the roots of the laurel was a dark, damp cavity, with a capacity of possibly one peck; the runway passed on through this cavity to the edge of a water hole, where I was unable to follow it further. Specimens of *Sorex richardsonii* and *Sorex personatus* were taken within a few yards of the place where the specimens of *Neosorex palustris* were obtained.

Two males of *Neosorex palustris* average in measurements: Total length, 147 mm.; tail vertebrae, 62 mm.; hind foot, 19.5 mm.; Two females average: Total length, 151 mm.; tail vertebrae, 62 mm.; hind foot, 19.5 mm.

There is a mounted shrew in the Public Museum of the City of Milwaukee, a male collected June 10, 1903, in Marinette County. The specimen is labeled "*Neosorex albibarbis*" but from external characteristics it appears to be *palustris*.

***Blarina brevicauda* (Say).**

Short-tailed Shrew.

Blarina brevicauda is common in nearly all parts of Wisconsin, but it is more common in the southern half of the state than in the northern half. This species chooses principally grassy fence lines and patches of weeds for its habitat. It is not often seen during the summer months; during the winter it seems to acquire more diurnal habits, and it may frequently be observed in its runways, especially on warm cloudy days.

***Condylura cristata* (Linnæus).**

Star-nosed Mole.

I have seen only two specimens of *Condylura cristata* from Wisconsin; one of these is in the collection of Dr. H. V. Ogden and was taken at Mercer, Iron County; the other specimen was taken near Stevens Point, Portage County. We can see no reason why this species should not occur frequently in northern Wisconsin but records have not established the fact.

***Myotis lucifugus* (Le Conte).**

Little Brown Bat.

Our present knowledge of the distribution of *Chiroptera* in Wisconsin is far from satisfactory. *Myotis lucifugus* undoubtedly has a much wider distribution in the state than our records indicate; we have seen specimens from Dodge, Jefferson, Milwaukee, Rock and Waukesha Counties.

***Lasionycteris noctivagans* (Le Conte).**

Silver-haired Bat.

This bat is found chiefly around lakes and water courses in

the southern part of the state; in most localities it is very common, but it is nearly everywhere outnumbered by *Lasiurus borealis*. I have seen no specimens of *Lasionycteris noctivagans* from northern Wisconsin.

***Lasiurus borealis* (Müller).**

Red Bat.

Lasiurus borealis is found in nearly all parts of Wisconsin; it may not occur in certain sections of the northern part of the state. My experience has been that the red bat is our most common bat, and also that it is the bat most frequently seen in cities and towns. This species shows great color variation.

***Lasiurus cinereus* (Beauvois).**

Hoary Bat.

I have examined only four specimens of this rare bat from Wisconsin. There is a male in the Milwaukee Public Museum, collected July 11, 1903, at Janesville, Rock County. A female, with two live young clinging to her, was brought to me on the evening of July 27, 1903; it was found dead in a yard on the east side of the public park in Milton, Rock County. The young were over one-third grown. Measurements of the adult female were as follows: Total length 149.6 mm.; tail vertebrae, 59 mm.; hind foot 13.8 mm.

REFERENCES.

1. Strong, Moses. List of the Mammals of Wisconsin. Geology of Wisconsin (Survey 1873-1879) Vol. 1. Chap. X. p. 440.
2. Miller, Gerrit S. Notes on the Mammals of Ontario. Proc. Bos. Soc. Nat. His. Vol. 28. No. 1. p. 16. (April, 1897).
3. Merriam, C. Hart. Monographic Revision of the Pocket Gophers. Family Geomyidae, (Exclusive of the species of *Thomomys*). U. S. Dept. Agr., Div. Biol. Sur. N. A. Fauna No. 8, p. 120. (Jan. 31, 1895).
4. Merriam, C. Hart, Loc. cit., p. 122.

5. Bangs, Outram. Proc. New Eng. Zool. Club. Vol. 1, p. 43. (June 5, 1889).
6. Ward, Henry L. A Weasel New to Wisconsin's Fauna. Bul. Wis. Nat. Hist. Soc. Vol. 5, No. 1, pp. 63-64 (Jan. 1907).
7. Baird, Spencer F. Mammals of North America, p. 32. (July 1857).
8. Baird, Spencer F. Loc. cit., p. 33.



HABITAT OF *Neosorex palustris* (RICHARDSON).



HABITAT OF *Neosorex palustris* (RICHARDSON).

FOSSIL CERCOPIDÆ (HOMOPTERA).

By T. D. A. COCKERELL.

In the Miocene shales of Florissant, at Station 14, we found an excellent specimen of *Palaphrodes irregularis* Scudder, preserved in exactly the same position as Scudder's fig. 6, Pl. 21 (Tertiary Insects), and showing the characteristic form and markings. It is a little smaller than the typical size—not quite 10 mm. long. Curiously, however, the venation of the wings (hind

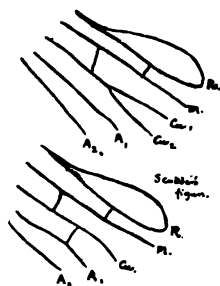


Fig. 1. *Palaphrodes irregularis* Scudder.

wings) does not agree with Scudder's figures. Using the nomenclature set forth by Kirkaldy (Leaf-Hoppers and their Natural Enemies, 1906), Scudder's figure shows the cubitus apparently simple, but with a cross-vein (which may represent the lower branch of the cubitus), going to the first anal. (Fig. 1, lower figure). Our specimen, on the contrary, shows the cubitus evenly forked, with no cross-vein to the anal. When at Cambridge, I sought diligently in the Scudder collection for the original of his fig. 6, but failed to find it; and I do not

know whether to consider the cross-vein an error of the artist's, or not. Scudder's description certainly agrees with his figure. I consulted Mr. Otto Heidemann on this point, and he very kindly wrote me at some length, also sending a series of Cercopidæ for comparison. Mr. Heidemann justly observes, that according to Scudder's description and figure, the venation of *Palaphrodes* does not accord with that of the Aphrophorinæ, to which it is assigned. My specimen, however, does so accord, and there is no doubt that the genus is very

close to *Aphrophora*, that is, *Cercopis*, according to Horvath, Kirkaldy, etc. The principal distinctive character may be found in the shape of the head,—very obtuse and rounded in front, and distinctly narrower than the thorax. The pattern of the tegmina is perfectly typical of *Cercopis* (*Aphrophora*) or *Lepyronia*—these two having essentially the same pattern. The venation of the wings, at least in my specimen, is entirely that of *Cercopis* (*Aphrophora*). The recent species compared are *Cercopis saratogensis* (Fitch), *C. parallela* (Say) and *C. quadrinotata* (Say). In Ball's figure of the wing of *Aphrophora* in Pr. Iowa Acad. Sci. 1895, the cross-vein between the media and cubitus is omitted, but it is present in the specimens examined, and doubtless its omission was accidental.

We obtained *Palecphora communis* Scudder at Stations 14 (*W. P. Cockerell*) and 17 (*S. A. Rohwer*), and *P. prævalens* Scudder at Stations 13 (*T. D. A. Cockerell*) and 14 (*W. P. Cockerell*, *Geo. N. Rohwer*). This genus has longer and slenderer tegmina than *Palaphrodes*, with the costa less arched. The pattern,



Fig. 2. *Palecphora communis* Scudder.

as Scudder remarks, is distinctive, though it could be derived from that of *Cercopis* without any very great change. The venation of the tegmina, as

figured by Scudder for *P. marvinei* Scudder, is in essential agreement with that of *Cercopis*, but is noteworthy for the rather numerous distinct nervures passing from the radius to the costal margin. The tegmina are rounded at the apex, not pointed. The hind wings, as well seen in our specimens of *P. communis*, are in general agreement with *Cercopis*, but offer a distinctive feature in the deflection downwards and bending of Cu_2 (see fig. 2). The relation of the radius to the media varies; it may be connected by a cross-vein as in *Cercopis*, or it may act-

ually join the media for a short distance—a condition approached in *Lepyronia*.

The variability of the venation of the wings of the *Cercopidæ* is undeniable, and it is of interest to note that the instability we find today existed as far back as the miocene. The color pattern of the tegmina really seems much more constant. In order to illustrate one more modification of the wing-venation, I give a diagram of the wing of a specimen of *Tomaspis bicincta* Say re-



Fig. 3. *Tomaspis bicincta* Say.

ceived from Mr. Heidemann. It will be seen that there are two little nervures leaving Cu_1 , but breaking off without forming cross-nervures. It will also be noted in *T. bicincta* (and this is normal for the genus, being just the same in the large Central

American *T. inca* Guér.) Cu_2 branches off from Cu_1 at a large angle, though it is not afterwards bent as it is in *Palecphora*. The figures accompanying this paper are pure diagrammatic, and are not intended to show specific minutiae.

Taking the North American genera of Cercopidæ, it is evident that as regards the venation *Cercopis* (*Aphrophora*) and *Lepyronia* stand at the foot of any phylogenetic tree, as being the most primitive. From *Aphrophora* or *Cercopis* we may readily derive *Philænus*, and from this we get two entirely diverse branches, one leading to *Clastoptera*, the other to *Monecphora* or *Tomaspis*. In *Tomaspis* we have a highly developed form, with the apical field of the tegmina densely reticulated and the color-pattern very different from that of *Cercopis*, namely two red or yellow cross-bars on a black ground. The beginnings of the *Tomaspis* pattern (with the divergence of the forks of the cubitus) are seen in the Florissant fossil *Prinecphora balcata* Scudder; while an almost typical *Tomaspis*-pattern is reached in the gigantic *Petrolystra gigantea* Scudder, the type of which I had the pleasure of examining in the Scudder collection.

Palaphrodes obviously is a relatively primitive Cercopid, near to *Cercopis*. *Palecphora* must be regarded as a branch of the same stem; not, so far as may be judged, in the line of evolution of any of the modern North American Cercopids; whether intimately related to any exotic genus, I cannot say. According to the conventional classification, *Palaphrodes* and *Palecphora* go in different sub-families, but they are doubtless more closely related than either is to *Clastoptera* on the one hand, or *Tomaspis* on the other.

THE PSEUDOSCORPIONS OF TEXAS.

BY NATHAN BANKS.

Some time ago Mr. C. T. Brues sent me some pseudoscorpions from Texas. Most of them were taken near Austin, and several of them from ant-nests. Two of these prove to be new species. This induced me to examine and determine all my Texan material in this order. There are 10 species, six of these belong to one genus *Chelanops*, four of them being new. One of the species found in an ant's-nest occurs also near Washington, D. C., often under large stones. The most common Texan species is *Chelanops oblongus*, a species widely distributed in the United States east of the Rocky Mountains. The two species of *Chelifer* are found in many parts of the eastern United States, the *C. cancroides* usually in houses or other buildings. When more attention is paid to collecting these creatures, no doubt the Texan list will be double what it is now.

***Chelifer cancroides* Linn.**

Brazos Co., New Braunfels.

***Chelifer muricatus* Say.**

Austin, and Esperanza Ranch, Brownsville.

***Chelanops oblongus* Say.**

Austin, in fungi; Brazos Co.; San Antonio; Brownsville; and Columbus.

***Chelanops texanus* Banks.**

Brazos Co.

***Chelanops unicolor* n. sp.**

Cephalothorax, palpi, and abdominal scutæ a uniform pale brownish yellow, rest whitish yellow. Cephalothorax nearly one and

one-half times as long as broad, narrowed and rounded in front, evenly and finely granulate, with two transverse furrows in the posterior part, the hind one indented in the middle; the hairs of cephalothorax are distinctly clavate, and on each of the dorsal scutæ are five strongly clavate hairs in a row. Palpi short and rather heavy, the hairs plainly clavate, except those on the fingers; the femur is scarcely as long as width of the cephalothorax; the tibia plainly shorter, very convex on inner basal part; the hand about twice as broad as femur, and as long as tibia, evenly convex each side, the fingers about the length of hand, stout and slightly curved. The hairs on under side of body are simple, but most of those on the basal joints of legs are clavate. Abdomen is about twice as long as broad, each side slightly convex. Length, 2 mm.

From nests of ants (*Eciton cæcum* and *Pachycondyla harpax*) at Austin Texas.

***Chelanops tumimanus* n. sp.**

Cephalothorax, scutæ, and palpi dark red brown, almost black, fingers rather paler, posterior margin of cephalothorax, except a median square, is pale yellowish; legs brownish on femora, femora III. and IV. quite dark; all hard parts finely and evenly granulate. The cephalothorax is about one and one-quarter times as long as broad behind, much tapering in front, eye-spots indistinct, the surface with some scattered very distinctly clavate hairs; each dorsal scutum with a row of fine clavate hairs near posterior edge, and one on middle of lateral edge. Abdomen fully twice as long as broad, each side slightly convex. Palpi heavy and short, clothed with very strongly clavate hairs, except those on the outer side of hand and those from the fingers; femur not as long as width of cephalothorax, very much swollen on outer base; tibia but little shorter and barely, if any, wider than femur, rather evenly convex on both sides, the greatest inner convexity at the middle; hand very heavy, twice as wide as femur, but scarcely as long as tibia, very much swollen on inner base; the fingers shorter than the hand, very stout and slightly curved. Venter with a row of dark spots each side, the hairs simple, but those on femora and outer side of tibiæ clavate. Length 2.5 mm.

San Antonio, August.

***Chelanops æqualis* n. sp.**

Cephalothorax and abdominal scutæ dark brown, palpi clear reddish brown, legs yellowish. Cephalothorax about one and one-quarter longer than broad behind, tapering and rounded in front, eye-spots indistinct, surface finely and evenly granulate, with short scattered thick hairs. Palpi large, trochanter with a swelling above and one behind; femur as long as width of cephalothorax, sides subparallel; tibiæ about as long as femur, slightly wider, the inner convexity is greatest before the middle; the hand is nearly as long as the tibia and about one and a half times wider, more strongly convex on inner than on the outer side; the fingers large, as long as hand, and only slightly curved; the hairs on the inner side of tibia, femur, and trochanter are almost clavate, the others are simple. The abdomen is about two and a half times as long as broad, the posterior edge of each scutum has from 9 to 11 simple hairs. Legs rather long and slender, with simple hairs; the hind femora not swollen. Length 3.3 mm.

From El Paso, Texas.

***Chelanops pulchellus* n. sp.**

Cephalothorax dark brown, with an oblong silvery white spot in each posterior lateral corner; abdominal scutæ brown, the outer end of most of them with a silvery mark; palpi dark-red brown, almost black in the swollen parts, but the fingers are very much paler. Cephalothorax nearly one and a half times as long as broad behind, much tapering in front, with a few short, thick hairs. Palpi rather short; femur scarcely as long as width of cephalothorax, outer side evenly convex, inside slightly concave before tip; tibia scarcely as long as femur, but plainly wider, the greatest inner convexity at about the middle; hand heavy, about as long as tibia and one and a half times wider, both sides evenly convex; fingers stout, a little shorter than hand; the hairs on inner side of tibia, femur, and trochanter short, and almost clavate. Abdomen fully twice as long as broad, each scutum with about 8 very short hairs on posterior margin. Legs short, hind femora distinctly thickened; the hairs on outer side of femora and tibiæ short and thickened. Length 2.3 mm.

Esperanza Ranch, Brownsville, Texas.

The six species of *Chelanops* now known from Texas may be separated by the following table:

- | | |
|---|-------------------|
| 1. Many hairs on palpi distinctly clavate..... | 2 |
| Hairs on palpi not plainly clavate..... | 4 |
| 2. Fingers equal to hand, which is not very large, small species
..... | unicolor |
| Fingers shorter than hand..... | 3 |
| 3. Hand very heavy, nearly twice as wide as tibiae..... | tumimanus |
| Hand not heavy, but little wider than the tibia..... | texasus |
| 4. Fingers plainly paler than the hand, small species..... | pulchellus |
| Fingers as dark as hand, larger species..... | 5 |
| 5. Fingers shorter than hand..... | oblongus |
| Fingers as long as hand..... | æqualis |

Ideobisium rufulum Banks.

From nest of *Camponotus sansabeanus*, Austin.

Olpium minutum n. sp.

Cephalothorax pale yellowish brown, darker in front, palpi yellowish brown, the fingers the darkest; abdominal scutæ yellowish, legs and venter whitish. Cephalothorax one and a-half times longer than broad, hind border rounded, but little narrowed in front, two distinct eyes each side close together. Palpi short; femur about as long as width of cephalothorax, a trifle wider at tip than near base, tibia nearly as long as femur and one and one-fourth times wider, the greatest inner convexity at middle, hand fully as long as tibia, one and one-fourth wider, sides but little convex; fingers stout, much shorter than the hand; hairs of palpi fine and uneven. Abdomen three and one-half times as long as wide, each scutum with 3 or 4 very fine hairs on posterior margin. Legs very short, hind femora slightly swollen, tarsi very short. Length 1.6 mm.

In nest of *Eciton cæcum*, Austin, Texas. Differs from *O. obscurum* in paler color, smaller size, longer abdomen, and more slender cephalothorax.

A RAPID MELANISTIC AND SUBSEQUENT PARTIAL ALBINISTIC CHANGE IN A CAGED ROBIN.*

BY HENRY L. WARD.

Early in November last I was told of a caged robin in the city that had suddenly turned black. On Nov. 6th I went to see this bird, which belongs to Mrs. T. J. Coughlin, and found a lively, pugnacious and apparently healthy robin with jet black plumage except for what appeared to be two small, white under-tail coverts. When viewed under strong illumination, and at a certain angle, the feathers of the breast were bordered with brownish black rather than being unicolor as otherwise they appeared. The eye-ring was not noticeable, the bill was nearly black and the anterior surfaces of the tarsi and upper surfaces of the toes were heavily suffused with black while their plantar surfaces were whitish flesh color. The tarsi are rather deeper, antero-posteriorly, than is normal, apparently due to excessive development of the scutes.

Its history as given me was that about four years previously it had been taken as an abandoned nestling by Mrs. Panton, a friend of Mrs. Coughlin, who had kept it in a cage in her kitchen. Thirteen months ago this friend died and the bird was transferred to Mrs. Coughlin's kitchen. For about the first three years of its life during its sojourn with Mrs. Panton the kitchen in which it was kept was used for cooking and washing. In Mrs. Coughlin's kitchen no washing and little cooking is done. The bird is in a large wire cage suspended by a pulley from the ceiling immediately in front of a south window. The room is perhaps eight

* Read before the joint meeting of the Wis. Acad. of Sciences, Arts and Letters and the Wis. Natural History Society Feb. 13, 1908.

feet in height and the bird, when I have seen it, has been about five and a half feet above the floor.

Up to the latter part of last September the bird had exhibited rather bright normal coloration when it began to moult. This process, which resulted in the extreme melanistic phase in which I first saw it, occupied about three weeks and had been completed some two weeks before my visit. I was assured that the bird had been in uniformly good health and that its diet of ground hemp, grated carrot and cornmeal with an occasional piece of apple to pick at, a minute amount of scraped raw meat, perhaps once a week, and in spring occasional meals of angle worms has been maintained during its entire life.

On January 28th last, I again saw the robin. The pigmentation of the bill had almost entirely disappeared and it was bright yellow except for a dusky spot near the tip of the culmen. Mrs. Coughlin informed me that this change had occurred within the preceding four days. The eyelids were much lighter than at my previous visit, appearing whitish at a distance and greenish yellow on close inspection. The tarsi and feet were also lighter in color, the pigmentation of their anterior surfaces seeming to have concreted so as to produce a faintly maculated effect.

About a week previously, after having bathed and while its feathers were erected, it was for the first time noticed that there were various white feathers underlying its sable plumage. I could detect these on various parts of its body and neck and a faint suggestion of fine, white streaking was noticeable when looking directly at the breast of the bird, probably due to underlying white. A third inspection on the 10th inst., showed a farther fading of the dusky spot on the culmen, and apparently an addition of one or more white feathers to the original two white under-tail coverts. Whether or not the white underlying feathers on other parts of its body had increased was difficult of determination. As the bird

is lively and pugnacious and desires to face one it is a rather unsatisfactory subject for detailed examination.

The facts of the previous life of the robin, of its sudden and remarkably complete change from normal color to melanochroism and its subsequent albinistic tendencies have been vouched for by Dr. P. H. McGovern who has been personally familiar with it for more than three and a half years.

On account of the season of year it has been impossible to make any tests as to the comparative degree of heat and humidity of this room and that of the open air when these factors might influence its plumage.

In making a partial review of the literature of the subject I note the following: Mr. Ruthven Deane¹ has listed 134 species of birds exhibiting more or less complete albinism and melanism of which 126 belonged to the former group and but 8 showed the latter peculiarity. There is no doubt that a white bird is more conspicuous and consequently more liable to attract attention than a black one but it is probable that the latter pathological condition is the less common.

In the Bulletin of the Nuttall Ornithological Club and in *The Auk*, covering a period of 32 years, I find mentioned five cases of melanism in the robin. One, presumably a wild bird, is mentioned by Deane². Another, a caged bird, was one of a nest of black robins taken at St. Johns of which Dr. Elliott Coues³ wrote in 1878: "Mr. Boardman writes me later, under date of September 23rd, that he has been much interested in watching the moult of the black robin, and says: 'He acts as if he were going to be an albino. His new tail is about half grown out, and is nearly white, with a black stripe down each feather. His breast, head, neck and back are jet black, but very much out of feather.'"

In 1884 W. B. Barrows⁴ called attention to a caged robin taken as a normal nestling (at Middletown, Conn.) about six years previously. At the fourth fall moult "a few white feathers were

noticed and here and there a black one." After the following fall moult the wings and tail were almost completely white while below he was clear black, except for a side patch of red under each wing and the usual white belly. The next fall moult brought forth the normal robin plumage which a year later was replaced by the following coloration: "Above clear black; tail mostly white; interscapulars and most of the wing feathers white on outer webs; chin, throat, belly and under tail coverts normal. The upper breast shows a somewhat crescent-shaped patch of red, and almost as continuations of this on either side are red patches under the wings. A few red feathers down the middle of the breast imperfectly separate the black which would otherwise form a single large pectoral patch. The white about the eyes is normal."

Barrows in 1885⁵ reports another robin taken at Middletown, Conn., as a normal nestling which retained its normal colors for two or three years. "Gradually the plumage became somewhat variegated with black and white, the black predominating above, though Mr. Leonard thinks the bird became ultimately almost white. There was no return to the normal plumage after the abnormal dress was once assumed." This bird died when about five years old.

Dr. Walter Faxon⁶ in 1886 cites a robin "as dark as a European Blackbird", kept in an aviary the owner of which informed him that "Robins thus raised in confinement were often thus colored." Mr. Faxon pertinently asks: "Is not the melanism to be connected with the peculiar conditions to which the bird is exposed? The aviary is built like a greenhouse, with one side (glass) sloping to the south. It has no artificial heat yet keeps southern birds (as Cardinal Grosbeaks) in good condition."

In these accounts it will be noticed that albinism and melanism are not infrequently, in fact are usually associated together.

It has long been supposed that humidity was conducive to the deepening of colors in birds and the colors of lepidopterous insects

have experimentally been greatly modified by subjecting the larva to abnormally high temperature. Recently Mr. C. W. Beebe at the gardens of the New York Zoological Society has carried on some important and significant experiments on the effects produced on the colors of birds subjected to slightly supernormal temperature accompanied by increased humidity. In his "Summary of the Effects of Humidity" on the Inca dove he states "Intrinsically the change is at first a segregation and intensification of the melanism, resulting in a clearing up and extension of the white or whitish areas. A period of equilibrium later ensues, until the increase of melanism is such that it begins to encroach upon the white areas, this continuing until all trace of white has disappeared."

In the Robins described by Barrows this sequence seems to have obtained: except that the one first reported became only incompletely melanistic while the second one as well as that described by Coues and our Milwaukee Robin have gone beyond this stage and developed a greater or less degree of albinism.

Beebe⁸ says farther: "The sporadic appearance or artificial inducing of melanism *in a single individual* under humidity may be explained, and probably correctly, as merely the result of intensified action of the pigment-producing enzyme or unorganized ferment." Accepting this theory it is natural to suppose that a point will be reached when this abnormal production of melanism will have exhausted the resources of the bird leaving it pigment-poor in which case albinism would succeed.

1. Bull. Nuttall Ornithological Club, Vol. I, pp. 20-24; Vol. IV, pp. 27-30; Vol. V, pp. 25-30.

2. Bull. Nuttall Ornithological Club, Vol. I, p. 24.

3. Bull. Nuttall Ornithological Club, Vol. III, p. 48.

4. The Auk, Vol. I, p. 90.

5. The Auk, Vol. II, p. 303.

6. The Auk, Vol. III, p. 284.

7. Zoologica, Vol. I, p. 30.

8. Zoologica, Vol. 1, p. 34.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. VI.

By CHARLES T. BRUES.

FAMILY BETHYLIDÆ.

Anisepyrus rugosicollis sp. nov.

Female. Length 4.5 mm. Black, the head, mesonotum, and scutellum purplish; pronotum greenish; base of antennæ and posterior legs honey-yellow. Head as wide as long, opaque, finely shagreened, with small, very irregularly arranged punctures interspersed; cheeks much more coarsely sculptured; mandibles honey-yellow with broad tips and four small black teeth. Antennæ 12-jointed; scape, pedicel and base of first flagellar joint honey-yellow; scape rather slender, curved, as long as the following four joints together; pedicel two-thirds longer than the first flagellar joint; second as long as the first, but thicker, quadrate: following joints scarcely growing narrower, quadrate or transverse quadrate. Eyes elongate oval, separated by one-third their length on the vertex and by about the same distance from the base of the mandibles. Ocelli placed in a small equilateral triangle. Pronotum widened behind, where it is nearly twice as wide as long, abruptly declivous in front; its surface greenish, shining, coarsely longitudinally rugose, with a punctate frenalum posteriorly; its lateral and posterior edges margined. Mesonotum as long as the pronotum, blue, with greenish reflections anteriorly on the middle lobe; its surface finely shagreened. Parapsidal furrows deep, convergent posteriorly; lateral furrows visible only behind. Scutellum purplish, subshining, with two foveæ connected by an impressed line basally and with several large punctures posteriorly. Metanotum with five longitudinal carinæ, besides the carinate lateral margins and posterior margin. Abdomen shining black. Legs black, the middle and posterior coxæ and trochanters brown; base of posterior femora ferruginous; middle tibiæ not spinous; tarsal claws with a single tooth. Wings brown with a hyaline band beneath the stigma and a pale apex. Venation normal, the marginal vein two and one-half times as long as the basal.

Described from a female specimen collected by Mr. Charles Schaeffer at Esperanza Ranch, Brownsville, Texas. Type in the Museum of the Brooklyn Institute of Arts and Sciences.

This species is similar to *A. fasciipennis* Kieffer from Nicaragua, from which it differs in the sculpture of the head and thorax, particularly the pronotum.

FAMILY SCELIONIDÆ.

Hoploteleia noveboracensis sp. nov.

Male. Length 4.25 mm. Black, very coarsely rugosely punctate; legs, except coxæ, honey-yellow; wings hyaline. Head large, twice as wide as thick anteroposteriorly. Occiput margined. Facial depression deep, margined, extending nearly to the anterior ocellus above, its surface transversely striate, although faintly so on the sides. Lateral ocelli separated from the eyes by less than their own diameter. Eyes ovate, bare, twice as long as the width of the cheeks. Mandibles black, tridentate. Antennæ 12-jointed, long and rather slender, black, the base and apex of the scape rufus; scape as long as the three following joints; pedicel small, triangular; first flagellar joint twice as long as the pedicel, and three times as long as thick; second slightly shorter; third shorter, a little over twice as long as thick; fourth and following about equal, but growing more slender, the fifth two and one-half times as long as thick, others three times; last joint one-third longer and pointed. Mesonotum with three furrows, less deeply impressed than in *H. floridana*, its surface shagreened, with fine scattered punctures and with distinct reticulate sculpture posteriorly. Scutellum coarsely rugoso-punctate, with a regular row of closely placed punctures along the posterior margin. Postscutellum bidentate medially. Metanotum very short, rugose. Pleuræ punctate-rugose, the mesopleuræ medially obliquely striate. Abdomen as long as the head and thorax; first segment and basal half of the second very coarsely striate or fluted; third the longest, faintly aciculate; fourth one-half as long as the third; fifth and sixth shorter, subequal. Legs, except coxæ, honey-yellow, the tarsi piceous. Venter faintly punctate. Wings hyaline, the marginal vein short, only three or four times as long as thick; postmarginal long, two-thirds as long as the submarginal;

stigmatal long, straight, with a small knob at apex, about two-fifths as long as the postmarginal.

One specimen, sent by my friend Mr. J. R. de la Torre Bueno, collected at Van Cortlandt Park, New York City.

This species can be distinguished from *H. floridana* Ashmead, the only other one known from the United States, by its longer and more slender antennæ. It is the only species known to extend so far north in its range, most members of the genus belonging to the neotropical region.

FAMILY SCHNEUMONIDÆ.

SUBFAMILY TRYPHONINÆ.

TRIBE MESOLEPTINÆ.

Oxytorus paludicola, sp. nov.

Male. Length 5—6 mm. Black; antennæ fuscous, most of legs and abdomen ferruginous. Head not quite twice as wide as thick, rather thickly hairy; subshining, the vertex, occiput, and cheeks faintly punctulate; face finely rugoso-punctate, distinctly produced below the base of the antennæ. Clypeus distinctly separated from the face, broad, its anterior margin truncate. Eyes elongate, very sparsely pilose, with not the slightest trace of an emargination between the antennæ. Antennæ stout and tapering, shortly pilose, 26-28 jointed, similar to those of certain Orthocentrine genera. Scape stout, oval; first flagellar joint distinctly longer than the second, which is twice as long as thick; following growing imperceptibly shorter and narrower, those near the tip quadrate. Mesonotum with the parapsidal furrows well marked, its surface punctulate on the sides, with the median lobe more coarsely punctate, especially behind, where it is confluent so. Scutellum with a wide deep fovea at the base divided by a median carina, apically convex and punctulate. Metathorax completely areolated, the lateral angles of the petiolar area produced as distinct teeth. Petiolar area transversely striate, the other areas rugose. Epomial carina of propleura distinct. Abdomen distinctly petiolate, smooth and shining, the petiole curved, more strongly so at the center; spiracles placed distinctly behind the center, where they give off lateral carinæ to the tip; two very strongly elevated median carinæ which

extend only to its posterior third; second and third segments subequal, each slightly broader than long. Legs moderately stout; anterior and middle pairs, except coxæ, fulvous; posterior pair, except coxæ in part, tarsi, tips of tibiæ, and tips of femora above, ferruginous. Clypeus and antennæ rufous, the former somewhat paler below. Palpi pale. Abdomen except the basal two-thirds of the petiole and extreme tip more or less ferruginous. Wings slightly infuscated; stigma elongate, piceous, veins piceous. Areolet very nearly regularly pentagonal; transverse median vein in hind wing broken just below the middle.

Described from two specimens collected by Professor T. D. A. Cockerell in a marsh at Florrissant, Colorado, July 26, 1908.

This species does not agree with the genus as characterized by Davis (Trans. Amer. Ent. Soc., Vol. 24, p. 322 (1897)), and *Mesoleptus facetus* Cress, which he refers to *Oxytorus* is evidently not congeneric with the present species, which however, agrees well with the characters given by Schmiedeknecht (Hym. Mitteleuropas, p. 621.)

TRIBE BASSINI.

Promethes rohweri, sp. nov.

Female. Length 4.25 mm. Black; face, underside of antennæ; marks on thorax and bands on abdomen, light yellow; legs light yellow and fulvous, to a slight extent variegated with black. Head about three times as wide as thick, smooth and polished, with faint indications of punctulation on the vertex and cheeks. Face smooth and highly polished, its central portion slightly elevated. Clypeus sharply separated from the face, rounded above, its lower margin deeply and broadly notched. Cheeks almost half the length of the eyes. Antennæ 22-jointed, distinctly shorter than the body; first flagellar joint as long as the scape; second two-thirds as long and about three times as long as thick; following gradually decreasing, the fifth twice as long as thick. Mesonotum shining, faintly punctulate, without trace of furrows. Scutellum shining, strongly convex. Metathorax incompletely areolated, the basal median, and first lateral areas indicated; second lateral area partly enclosed; petiolar absent. Mesopleuræ smooth and highly polished, pro and metapleuræ punctu-

late. First abdominal segment twice as long as wide at tip, the spiracular protuberances unusually large; lateral carinæ distinct, but no trace of any median ones. Second segment as long as the first and somewhat longer than wide at tip, the gastrocœli unusually large and deep; first and segment except the tip of the latter rugulose; following segments smooth and polished. Legs slender, four anterior ones yellow, their coxæ black basally and their femora with a short black stripe inwardly at the base. Posterior coxæ black, their tips and the trochanters yellow; femora pale ferruginous, with a black stripe inwardly at the base; tibiæ and tarsi pale ferruginous, the tibial spurs weak, only one-third the length of the metatarsus. Wings hyaline, stigma piceous with pale spot at base; veins piceous. Areolet open, indicated as a regular pentagon; transverse median vein in hind wing broken at the middle. Entire face, anterior orbits, mandibles except tips, palpi, underside of antennæ, lower part of cheeks, cuneiform marks on mesonotum, tegulæ, spot in front and below, large spot on mesopleura on anterior margin below, and line on posterior margin above, and bands on second to fourth abdominal segments more or less emarginate posteriorly, pale yellow.

Male. Differs by its more elongate form, 25-jointed antennæ and interrupted band on second abdominal segment. Length 6 mm.

Described from four specimens sent me by Mr. G. A. Rohmer of the University of Colorado, who collected them on flowers of *Ribes vallicola* at Florissant, Colo., June 11, 1907.

Zootrephes similis sp. nov.

Female. Length 5 mm. Black; abdomen, except base and apex, and legs ferruginous. Head three times as wide as thick, shining, the face finely punctate. Front and vertex polished, occiput and cheeks finely punctured; clypeus smooth and shining, its anterior edge subemarginate. Upper tooth of mandibles deeply divided. Eyes bare, separated on the front by a distance equal to their length. Antennæ black, 22-jointed; basal joint of flagellum one-half longer than the second; following growing shorter, those near the middle twice as long as thick. Pro and mesonotum finely punctulate, shining; no trace of parapsidal furrows. Depression at base of scutellum shallow, polished. Metathorax completely areolated, the carinæ very strong. Pleuræ shining, almost smooth. Abdomen subopaque, more shining

toward the tip; first segment one-third longer than broad at apex, its basal half with two very strong carinæ which become evanescent just beyond the middle, lateral carinæ strong and well away from the margin; its surface longitudinally rugose. Second segment as broad as long, third wider and shorter, both scabrous or finely rugulose; fourth punctulate at the base, apical ones smooth and shining. Legs ferruginous, the coxæ, particularly the posterior pair, black basally, their tips and the trochanters pale yellow; posterior tarsi piceous. Wings hyaline, the stigma and veins piceous black, the former pale basally; areolet open, its proximal shorter than its lower side; transverse median vein in hind wing broken at the middle. Clypeus, broad anterior orbits, two paired spots on face, mandibles except tips, spots at base of antennæ above, under side of pedicel, tegulæ, spot below and before; cuneiform spot on mesonotum, short line near anterior margin of mesopleura, spot at base of hind wing, and a large mark on scutellum, pale yellow. Second to fourth segments of abdomen ferruginous, the second and third yellowish at apex and the fourth darker at base; following segments with a rufous margin.

Beulah, New Mexico, Aug. 3, 1902, Prof. T. D. A. Cockerell.

This differs from *Z. saginatus* Prov. to which it is most closely related, by the black antennæ, the absence of any transverse line on the third segment, and the entirely black first abdominal segment. It is slightly larger.

***Syrphoctonus lævis* sp. nov.**

Female. Length 6 mm. Black, legs, except tips of posterior tibiæ and tarsi which are ferruginous, pale yellow; spots on face and mesonotum pale yellow. Head two and one-half times as wide as thick, finely shagreened, with microscopic punctures intermixed. Face rather strongly depressed on the sides, between the eye-margin and the central convex portion. Clypeus strongly raised, its anterior margin rounded and deeply incised medially. Eyes not quite so long as the width of the face; bare. Antennæ 21-jointed; first flagellar joint one-third longer than the second, which is three times as long as thick and about as long as the scape; third and following growing shorter, the fifth about two times as long as thick. Mesonotum subshining, faintly punctulate; scutellum shagreened and punctulate. Metanotum punctulate or scabrous, without any indications of any areas. Pleuræ shin-

ing, very faintly punctulate and shagreened. Abdomen rather stout, the first segment, basal third of the second, and base of third, scabrous, remaining portions shining. First segment about one-half longer than wide, its lateral carinæ well-defined, sharp, no trace of central ones; second segment slightly shorter than its width at tip. Valves of ovipositor black, distinctly projecting. Venter shining black, the sutures of the basal segments whitish. Legs, including coxæ and trochanters, very pale ferruginous or honey-yellow. Tips of posterior tibiæ and posterior tarsi entirely, deep black; longer spur of hind tibia a little less than one-half the length of the metatarsus. Wings hyaline, stigma piceous, scarcely pale at the base; veins piceous; areolet open, its position indicated as a large almost regular pentagon. Transverse median nervure in hind wing broken considerably below the middle. Face with a median broad yellow stripe extending to the antennæ; clypeus and mandibles, except tips, yellow. Mesonotum with lateral cuneiform lines, tegulæ, spot at base of hind wing, continued as a narrow stripe between the meso and metapleuræ, and scutellum, except center, pale yellow.

Described from a female collected by Prof. T. D. A. Cockerell, at Beulah, New Mexico, during July.

This species is related to *pleuralis* Cress. and to *robustus* Davis. It is separable from the former, by its black pluræ and metathorax and fewer yellow markings, and from the latter by its much smoother body sculpture, and the absence of any central ridge on the abdomen.

***Enizemum neomexicanum* sp. nov.**

Female. Length 6 mm. Black; legs, except posterior tibiæ and tarsi, bright ferruginous. Head about three times as wide as thick, subopaque and minutely punctulate. Occiput with a median groove or depression behind the median ocellus. Face shagreened, with fine punctures interspersed; at the upper edge of the clypeus with a pair of foveæ. Clypeus bilobed, with a median emargination. Eyes as long as the width of the face, subemarginate opposite the base of the antennæ. Antennæ 23-jointed, nearly as long as the body, the first flagellar joint very long, following gradually shorter to the tip, those near the middle about three times as long as thick. Mesonotum shining, finely punctulate, without any trace of parapsidal furrows;

scutellum with somewhat larger punctures. Metanotum finely rugose, the basal median area indicated, also the lateral carinæ, and very indistinctly the petiolar area. Pleuræ finely punctate, and metapleuræ more closely so. First abdominal segment a little longer than wide at apex, with two central carinæ which extend to the middle of the second segment, and with lateral carinæ which extend nearly to the apex of the second. First and second segments longitudinally rugose; third scabrous, apical ones nearly smooth. Legs entirely bright ferruginous, except the base of the anterior coxæ, and the posterior tibiæ and tarsi, which are deep black, the former with a white ring at the base. Spurs of posterior tibiæ long, the longer one one-half the length of the metatarsus. Wings nearly hyaline, the veins and stigma dark fuscous, latter pale at base. Areolet very small; transverse median vein in hind wing broken at the middle. Clypeus ferruginous; mandibles, except tips, yellow; small lateral mark on mesonotum, tegulæ, spot before and behind, spot at base of hind wing, and capillary lines behind scutellum and postscutellum white.

Beulah, New Mexico, Cockerell.

Differs from *Enisemum (Bassus) tibiale* Cress, by the black antennæ, scutellum and pleuræ, and partially areolated metanotum.

FAMILY BRACONIDÆ,

SUBFAMILY BLACINÆ.

Blacus gracilis sp. nov.

Female. Length 3 mm. Black; base of antennal flagellum, legs in part and venter yellowish. Head transverse, twice as broad as thick antero-posteriorly. Occiput and cheeks broadly rounded, the former impressed medially; surface punctulate, more or less shining, especially on the occiput. Face protuberant above the insertion of the antennæ. Front flattened and deeply concave centrally to accommodate the scape. Antennæ 28-jointed; scape very thick, rounded, a little longer than the second joint, following decreasing very gradually to the tip. The antennæ are pale brownish yellow on the basal half, except the scape, above which is black like the apical part of the flagellum. Clypeus and mouth parts honey-yellow. Face strongly raised medially, the elevation forming a sharp carina above; at the sides of the clypeus with a deep foveate impression. Thorax slender, delicately sculptured,

the parapsidal furrows sharp and deep, meeting far in front of the scutellum. Pleuræ subshining, finely rugulose; metanotum sculptured like the pleuræ, not areolate, with a single very poorly defined median carina, a transverse carina at the upper edge of the posterior slope, and a reflexed margin at its lower edge. Abdomen slender, shagreened at the base, smooth and shining posteriorly. First segment twice as wide as long, its tip less than twice as wide as its base; spiracles strongly protuberant, placed very near the base. Second segment quadrate, following growing shorter, the apical ones whitish at the sutures. Ovipositor slightly longer than the abdomen, pale, its sheaths black. Legs brownish-yellow; the hind coxæ blackish at the extreme base; hind femora and tibiæ dark at tips and their tarsi dusky. Wings hyaline, veins except the costal very pale. Marginal cell narrow, pointed, reaching only three-fifths the distance from the stigma to the wing tip; first and second sections of the radius almost perpendicular to each other. Submedian cell barely longer than the median; recurrent nervure and transverse cubitus interstitial. Discoidal and subdiscoidal nervures uniting in a curve. Stigma very narrow.

One female bred from insects in heads of clover at Minneapolis, Minn., sent me by Mr. A. G. Ruggles of the Minnesota Agricultural Experiment Station.

Public Museum, Milwaukee,

March 26, 1908.

REVIEW OF THE DRAGON-FLIES OF WISCONSIN.

BY RICHARD A. MUTTKOWSKI.

The fauna of Wisconsin, especially that pertaining to the insects, has been but little explored. Except for Milwaukee County, which has been rather thoroughly canvassed by entomologists, there are probably only ten counties out of seventy-one where collections of dragon-flies have been made to any extent. To arouse the interest of entomologists in Wisconsin and to encourage the study of our most interesting fauna, this review has been prepared.

HISTORY OF THE ODONATA. In early times probably no other order had attributed to it pernicious qualities to such an extent as the Odonata. Such beliefs as their supposedly poisonous bite, the malevolent properties of the brown excretion, the fearsome consequences of their sting, were only too common. Thus is remained for Linnæus to glean whatever truth there was from the mass of contradictory superstitions. But one name stood out from the numerous appellations, the name of Water Nymph; at once Linnæus recognized the appropriateness of the name, and from that time our knowledge of the Odonata is dated. Among the first to comprehensively treat the group was Reaumur, who indicated the natural subdivisions of the Odonata, his suggestions being later utilized by Fabricus, who first proposed for the group the name Odonata. Following him, Leach, Say, Burmeister, Hagen, de Selys-Longchamps, and recent workers have increased our knowledge, until at the present time the Dragon-flies are fairly well-known.

The name Odonata signifies tooth and is characteristic in view of the greatly developed labial teeth of the nymph. Of common

names we have a series, such as damsel-flies, dragon-flies, horse-stingers, snake-feeders, spindlers, skimmers, for the whole order, and a few—amber-wing, white-face, dog-tail, marking the distinctive features of a species or genus. Of these names “damsel-flies” and “dragon-flies” are the most common, and considering the two types of Odonata, the dainty name of damsel-flies for the more timid, weaker types, and dragon-flies for the larger, formidable and predatory types are peculiarly appropriate.

CHARACTERS. The Odonata form one of the more primitive orders of insects and their characters may be summed up briefly thus: Wings four, sub-equal, net-veined, provided with a spot near the apex, the stigma, tarsi three-jointed, antennæ short, inconspicuous; metamorphosis incomplete.

LIFE HISTORY. From the time the egg hatches to the moment when the adult dragon-fly casts off its nymphal skin there is no well defined series of molts as among the higher orders of insects. The metamorphosis is incomplete since the larva has its later character indicated by the rudimentary wing-cases, the great eyes, and the big labial lobes. In all stages the insect is restive, never seeking complete quiet and solitude preparatory to emergence. The habits of the nymph are predatory, the methods applied when hunting for prey being three-fold; crawling, burrowing, and clinging. The last method is applied by the Agrionidæ, Aeschninæ and the greater number of Libellulinæ. Crawling is applied by the Macrominæ, Cordulegasterinæ, and the smaller part of the Libellulinæ; the nymphs sit among the rubbish at the bottom of ponds, rivers and slow bodies of water and aided by their protective resemblance to the surroundings, wait in greedy ambush for their unsuspecting prey. The representatives of the third group, comprising the Gomphinæ, burrow in the silt and sand of river-bottoms for their victims.

When the adult dragon-fly has cast off its skin, it usually rests

on some stone or stick near the water-level to unroll and dry the wings before flying. Different species have different habits in effecting this change. Some are indiscriminative in choice of locality and well satisfied to complete the transformation wherever they emerge; others seek the solitude of dark wash-outs in the river-banks; and again others climb into the shore-grass. The habits of the imago are varied; some are retiring, staying near their larval habitat, others seek open fields, while still others fly in the rush and roar of rapids and waterfalls. The females lay the eggs usually by flying near the water-level, and dipping the tip of the abdomen into the water while in flight to deposit an egg. In the case of some genera the males accompany the females. In quiet places the eggs remain clustered, while in more turbulent waters, they are scattered widely by the force of the currents.

Like the nymph, the adult dragon-fly is predatory, and the whole form of the imago is adapted to this form of life. The peculiarly unbalanced appearance of the body, the thorax sloping forward and behind, with the slanted wings on the rear slope, the position of the legs near the forward edge of the thorax, are all splendidly adapted for the seizure and holding of the prey.

RELATION TO LIFE ZONES. In Wisconsin the south-eastern and southwestern parts are comparatively low in altitude, and the character of its life temperate—Upper Austral. The southern part of the state in its middle portions is transitional in character, due to higher elevation, and the central part is occupied by a great basin lower than the south-eastern counties, but transitional in character. From this basin the state is gradually elevated north to the Penokee and Iron ranges, all this area occupied by transition forms. North of this natural water-shed the character of life assumes a boreal aspect, due to higher latitude and increased altitude. Thus the state is separated into three distinct life zones: temperate—Upper Austral, near-boreal (partly tem-

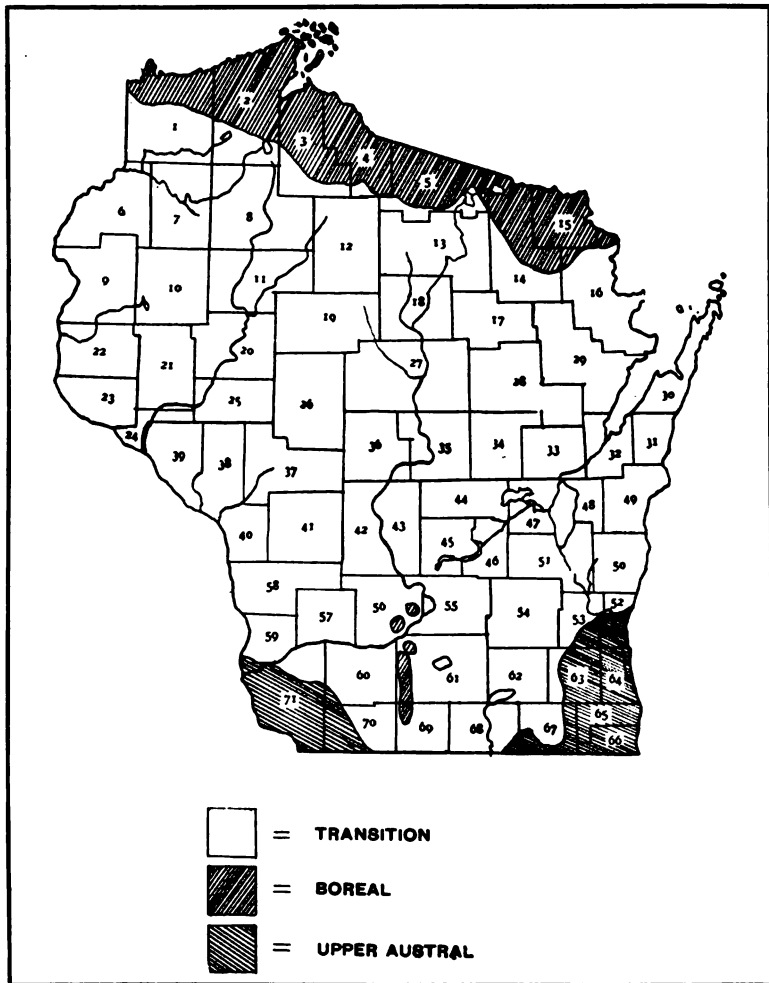
perate, partly boreal)—Transition, and arctic—Boreal. In Wisconsin latitude is of greater moment and altitude of only secondary importance, since the contour of the state is with few exceptions comparatively flat.

Due to the fact that dragon-flies are little influenced by considerations of food since they are omnivorous, their distribution exceeds that of the species of most orders of insects. Wherever there is water the dragon-flies of that respective life area are likely to occur. A very interesting illustration of the similarity of the Odonata throughout a life zone is the striking resemblance of the fauna of the White Mountains of New Hampshire and of Northern Wisconsin. The White Mountains are placed in the midst of a trans-austral region, and because of their altitude the character of their fauna and flora is boreal. Whatever records of insects we have from boreal Wisconsin are identical with the White Mountains records.

SEASONAL DISTRIBUTION. Imagos fly from April to November. But the great months for dragon-flies are June and July. Some species fly during the greater part of the season, while others are seen for but a very short time. The twilight hours of evening are the favorite hours of hunting and also of transformation. Species, however, chiefly of the Libellulinæ and Agrioninæ, fly also in the morning, but at the time their flight is stiff and slow, owing to the chill of the night.

It is doubtful whether the Odonata normally hibernate; but a specimen of *Anax junius* has come under my observation which was still alive in March when it was blown down from beneath the eaves of a building where it had passed the winter. Such cases are however very unusual.

FOOD HABITS AND ECONOMIC VALUE. Throughout all stages of its life the dragon-fly is carnivorous, and will eat anything that it is able to capture and hold. The creature is insatiate and with its predatory instinct it preys all the time, even

**MAP ILLUSTRATING THE LIFE ZONES OF WISCONSIN**

1 Douglas, 2 Bayfield (with Apostle Islands), 3 Ashland, 4 Iron, 5 Vilas, 6 Burnett, 7 Washburn, 8 Sawyer, 9 Polk, 10 Barron, 11 Gates, 12 Price, 13 Oneida, 14 Forest, 15 Florence, 16 Marinette, 17 Langlade, 18 Lincoln, 19 Taylor, 20 Chippewa, 21 Dunn, 22 St. Croix, 23 Pierce, 24 Pepin, 25 Eau Claire, 26 Clarke, 27 Marathon, 28 Shawano, 29 Oconto, 30 Door (with Islands), 31 Kewaunee, 32 Brown, 33 Outagamie, 34 Waupaca, 35 Portage, 36 Wood, 37 Jackson, 38 Trempealeau, 39 Buffalo, 40 La Crosse, 41 Monroe, 42 Juneau, 43 Adams, 44 Waushara, 45 Marquette, 46 Green Lake, 47 Winnebago, 48 Calumet, 49 Manitowoc, 50 Sheboygan, 51 Fond du Lac, 52 Ozaukee, 53 Washington, 54 Dodge, 55 Columbia, 56 Sauk, 57 Richland, 58 Vernon, 59 Crawford, 60 Iowa, 61 Dane, 62 Jefferson, 63 Waukesha, 64 Milwaukee, 65 Racine, 66 Kenosha, 67 Walworth, 68 Rock, 69 Green, 70 Lafayette, 71 Grant.

attacking its own kind, when nothing else offers. The nymph eats insects, small fish, tadpoles and other aquatic animals. The food of the imago is formed chiefly of insects, such as mosquitoes, flies, and occasionally moths. Undoubtedly the economic value of the adult dragon-fly is great, since myriads of harmful insects are destroyed by them. The nymph, too, partakes of this attribute though its economic value is less certain. In fact, at times nymphs may become a regular plague by over-population, to the detriment of other aquatic animals. Instances are known where large fish-ponds were completely depopulated by voracious odonate nymphs that infested them. For voracity these nymphs easily take the crown among insects.

COLLECTION AND PRESERVATION. In the capture of dragon-flies activity is the most necessary requirement. Their flight is usually so rapid that often they cannot be caught by pursuit, but must be met with according to their own tactics. Waiting till the dragon-fly alights which it usually does near its original resting-place, a rapid swoop with the net from behind will prove efficient. A sweep with the water-net along the bottom of shallow ponds and rivers will land many nymphs. Later in the season the rank growth on the bottoms prohibits the use of a net, when a rake is advisable.

For preservation the rapid drying process is the most adequate. A slit on each side of the thorax and in the venter of the basal abdominal segments, with exposure to the direct rays of the sun will complete drying within little more than an hour, and preserve the original colors. Thus prepared the insect should be placed in a dark cabinet. Alcohol is a commendable medium for the preservation of smaller species, since it retains the original coloration. This is well for exhibition purposes, but for collection series it is impracticable. There the drying process is likewise the best, though fading of colors is unavoidable; but since dragon-flies are usually common where they occur they are readily replaced.

BIBLIOGRAPHY. The following works will supply most of the information necessary for any more extensive study of our fauna.

HAGEN. Synopsis of the Neuroptera of North America. Smithsonian Miscellaneous collections, Washington, 1861.

KIRBY. A Synonymic Catalogue of Neuroptera Odonata or dragon flies. London, 1890, pp. 202.

BANKS. A Synopsis, catalogue, and bibliography of the Neuropteroid insects of temperate North America. Trans. Am. Ent. Soc., 1892, pp. 328-373.

CALVERT. Catalogue of the Odonata (Dragon flies) of the vicinity of Philadelphia. Trans. Am. Ent. Soc. 1893, pp. 152-272, 2 pls.

KELLICOTT. The Odonata of Ohio. Ohio Acad. Sci., Special paper No. 2, 1899, pp. 114, 3 pls.

WILLIAMSON. The Dragon-flies of Indiana. Indiana Geolog. Rept. f. 1899 (1900), pp. 229-333, 7 pls.

NEEDHAM. Aquatic Insects of the Adirondacks, Odonata. Bull. New York State Mus., pp. 429-540 (1901). (Suborder Anisoptera.)

NEEDHAM. Idem, Bull. No. 68, pp. 218-279 (1903). (Suborder Zygoptera.)

NEEDHAM. A Genealogic Study of Dragon-fly wing venation, Proc. U. S. Nat. Museum, Vol. 26, pp. 703-764, 24 pls (1903).

MATERIAL STUDIED. The material used for the present paper is chiefly that contained in the Milwaukee Public Museum collections, in great part collected by Messrs. Charles E. Brown, Valentine Fernekes, Frederick Rauterberg, and others, from Milwaukee and Waukesha Counties, principally from 1900 to 1903; collections by expeditions from the Museum in Door County in 1905; in Vilas, Iron and Bayfield Counties in 1907; collections by Mr. Henry L. Ward from Washington County in 1907; and many single specimens from odd localities, chiefly from the counties mentioned. Lists of collections from Dane County were obtained through the kindness of Prof. Philip Calvert, of the University of Pennsylvania and of Prof. William S. Marshall, of the University of Wisconsin. Obligations are due to Mr. Charles T. Brues, un-

der whose direction this paper was prepared, for the many valuable suggestions offered and thankfully accepted. Local lists of Odonata from various parts of the United States and Canada, that appeared chiefly in the Entomological News and the Canadian Entomologist, the Ohio Naturalist and other periodicals, have furnished valuable data for the designation of a bounded life zone for each species.

Milwaukee Public Museum.

March 4, 1908.

ORDER ODONATA.

Even a perfunctory examination of a collection of Odonata will reveal two distinct types of dragon-flies, the one composed of small species with equal wings, folded in repose, and long, cylindrical abdomen, the other of larger species with unequal wings, extended horizontally in repose, the abdomen tapering, the segments of uneven girth. The former type includes timid species that flit gracefully among the weeds and rushes of woods and waters; this is the real damsel-fly. The other comprises bolder species that haunt the surface of the water, the lower flora of the ground as well as higher vegetation. Darting here and there with lightning speed, or rustling in the weeds in search of their food, they better merit the name of "dragon-fly" than the smaller, daintier damsel-fly. On the characteristics just stated is based the natural division into suborders:

1. Wings similar in shape, folded in repose; eyes wide apart..... Suborder
ZYGOPTERA (Damsel-fly).
2. Wings dissimilar in shape, hind wings wider at the base, extended horizontally in repose, eyes touching or but little separated Suborder
ANISOPTERA (Dragon-fly).

The families are separated as follows:

1. Wings alike, eyes widely separated; a quadrangle on the basal third of the wings..... 2
Wings dissimilar, eyes approaching or approximated, a triangle on the basal third of the wings..... 3
2. Quadrangle of wings crossed, more than two antecubitals.....
..... **Calopterygidae**
Quadrangle of fore wings free, two antecubitals only.... **Agriionidae**

3. Triangles of wings with the axis parallel to the wing; antecubitals of the first and second series not corresponding.... **Aeschnidae**
 Triangles of the fore wings with axis at right angles to the wing, of hind wings coinciding with wing.....**Libellulidae**
 The sub-families are arranged similarly. /
1. Eyes far apart..... 2
 Eyes approaching, or approximated..... 3
2. Wings with numerous antecubitals.....(1) **Calopteryginae**
 Wings with two antecubitals.....(2) **Agrioninae**
3. Antecubitals of the first and second series not corresponding.. 4
 Antecubitals of the first and second series mostly corresponding 7
4. Stigma with a brace vein at inner end in space below..... 5
 Stigma without brace vein.....(3) **Cordulegasterinae**
5. Subtriangle of fore wing of one cell..... 6
 Subtriangle of fore wing of three cells.....(4) **Petalurinae**
6. Eyes separated by a wedge-shaped occiput.....(5) **Gomphinae**
 Eyes touching for some distance.....(6) **Aeschninae**
7. Triangle of hind wing level with arculus, or before it..... 8
 Triangle of hind wing beyond the level of the arculus.....
(7) **Macromiinae**
8. Eyes tubercled behind.....(8) **Cordulinae**
 Eyes not tubercled.....(9) **Libellulinae**

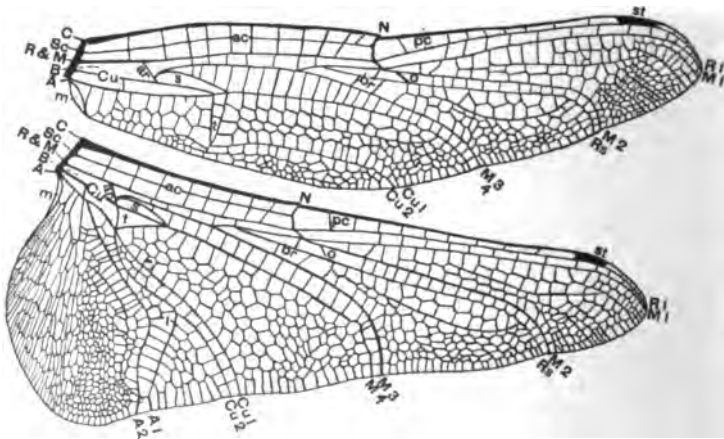
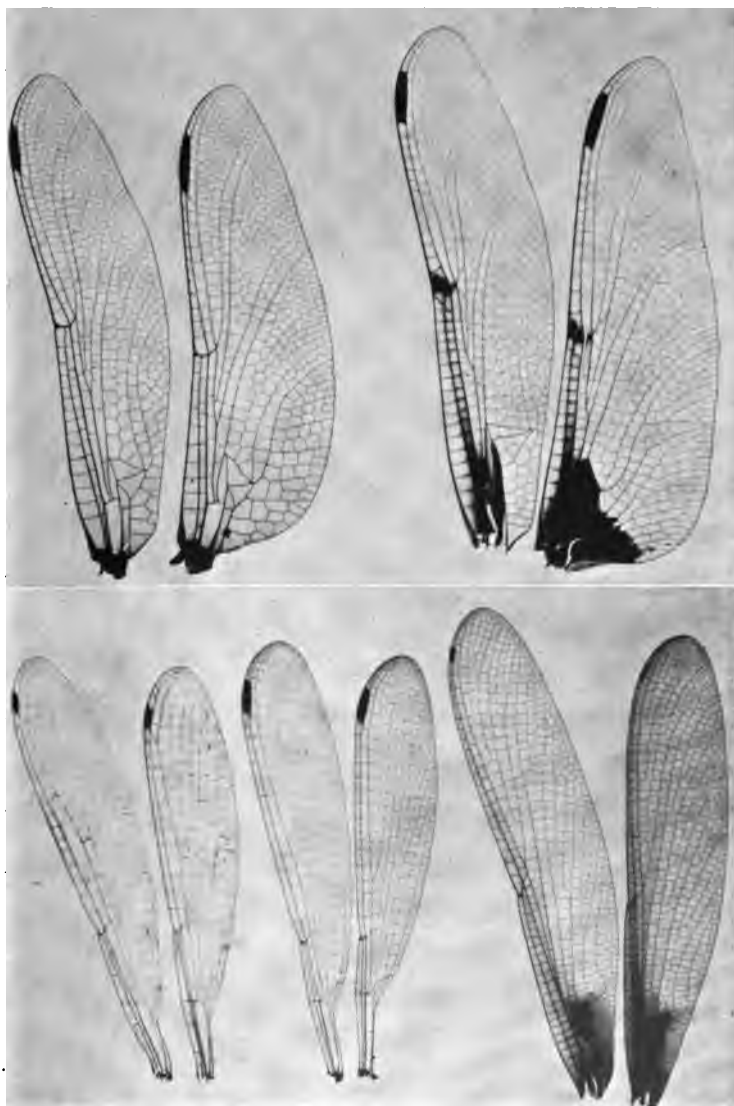
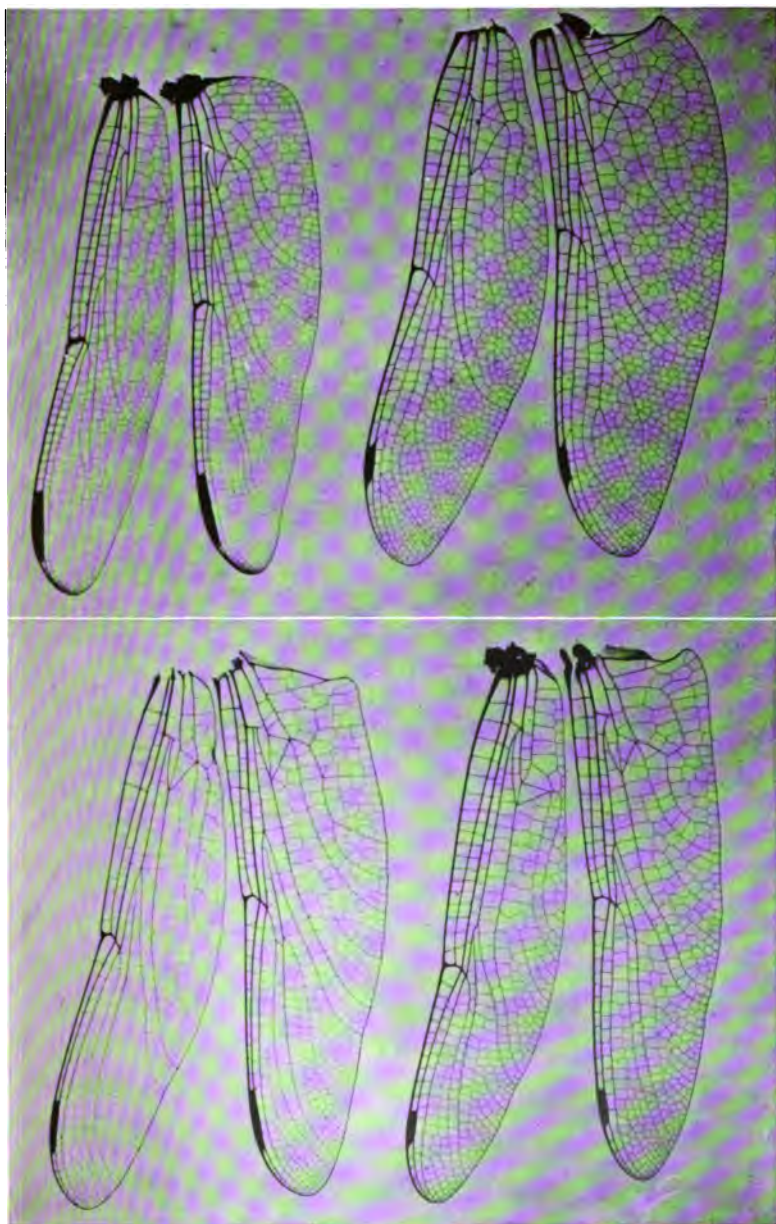


Fig. 1. WINGS OF *TRAMEA CAROLINA* (LIBELLULINÆ), SHOWING NOMENCLATURE.



GOMPHUS FRATERNUS.
TETRAGONEURIA SPINIGERA.

LESTES RECTANGULARIS.
ARGIA PUTRIDA.
HÆTERINA AMERICANA.



LIBELLULA INCESTA.
ÆSCHNA CONSTRICTA

CORDULEGASTER OBLIQUUS.
MACROMIA ILLINOIENSIS.

For convenience the Comstock-Needham nomenclature and the other more commonly used by older writers are placed in juxtaposition, the recent system to the left.

C.....	Costa or costal vein.
Sc.....	Subcosta or subcostal vein.
R. & M.....	Radius & media..... Median vein.
B.....	Basilar space.
Cu.....	Cubitus..... Submedian vein.
A.....	Anal vein..... Postcosta.
R1.....	First radial vein..... Median vein.
Rs.....	Radial sector..... Subnodal sector.
M1.....	First media..... Principal sector.
M2.....	Second media..... Nodal sector.
M3.....	Third media..... Median sector.
M4.....	Fourth media..... Short sector.
Cu1.....	First cubital vein..... Upper sector of the triangle.
Cu2.....	Second cubital vein..... Lower sector of the triangle.
A1.....	First anal vein.
A2.....	Second anal vein.
N.....	Nodus.
st.....	stigma or pterostigma.
ac.....	antecubitals.
pc.....	postcubitals.
o.....	oblique vein.
br.....	bridge.
ar.....	arculus.
s.....	supra-triangular space.
t.....	triangle.
l.....	anal loop (resembling a foot.)
m.....	membranule.

The spaces at the base of the wings below the costa, subcosta, media and the cubitus may be called, respectively,—costal, subcostal, median and cubital space.

SUB-ORDER ZYGOPTERA.

FAMILY CALOPTERYGIDÆ.

SUB-FAMILY CALOPTERYGINÆ.

The sub-family includes two genera, *Calopteryx* and *Hæterina*. The species readily attract the attention of the observer by their metallic colors, bodies a beautiful blue and green, and wings clouded with brown or black. In general their habits are retiring. They frequent ponds, springs, and also strong, steadily flowing waters. The two genera are distinguished as follows:

Wings broad, basilar space free.....	Calopteryx
Wings narrower, basilar space cross-veined.....	Hæterina
CALOPTERYX Leach, Edin. Encycl. 9, p. 137, 1815; Needham, Proc. U. S. Nat. Mus., 26, p. 715, 745, 746, 1903 (Venation).	

A genus of wide distribution, numbering about 18 species.

They vary in body colors from blue to green, the wings from yellow to black, the former color more common in the females. The males are without stigma on the wings, which is as often present as not in the females. Our northern species may be separated by the following table:

- | | |
|---|----------------------|
| 1. Wings narrow, front and hind margins sub-parallel..... | 2 |
| Wings widening, the hind margin rounded..... | 4 |
| 2. Wings uniformly colored, or clear..... | 3 |
| Wings with the apical sixth black..... | <i>dimidiata</i> |
| 3. Wings clear..... | <i>augustipennis</i> |
| Wings yellowish..... | <i>amata</i> |
| 4. Wings uniformly black or brown..... | <i>maculata</i> |
| Wings with the base clear, the apical third black..... | <i>æquabilis</i> |
- Calopteryx maculata*** Beauvois, Ins. Afr. Am., p. 25, 1805; Hagen, Syn. Neur. N. Am., p. 57, 1861; Needham, Bull. 68 N. Y. State Mus., p. 224, 1903 (Bibliography and desc. of nymph); Needham, Proc. U. S. Nat. Mus., 26, p. 745, 1903 (Venation).

Abdomen male 32—37, female 32—35, hind wing male 26—28, female 28—31.

Male.—Colors blue or green, with black markings. Thoracic carina, humerals, and legs black. Wings from light brown to black, costa blue or green. Abdomen black below except on the apical segments which are whitish. Appendages black, superiors forcipate, thickened apically, outwardly denticulated, an inner median tooth. Inferiors two-thirds as long.

Female.—Similar. Wings usually of light brown, the stigma white, if present. Abdomen brown, the three apical segments with a white-mid-dorsal stripe.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Milwaukee Co., June 1899; June 1902, 1903; Waukesha Co., June 1902, 1903; Door Co., Jacksonport, June 25—30, 1906; Vilas Co., June 24—30, 1907; Washington Co., Little Cedar Lake, Aug. 1—15, 1907.

Time and Habitat—Over rippling streams from May to August.

Calopteryx æquabilis Say, Journ. Ac. Sci. Phila., 8, p. 33, 1839; Hagen, Syn. Neur. Am., p. 58, 1861; Needham, Bull. 68 N. Y. State Mus., p. 223, 1903 (Bibliography & Dees. of nymph).

Abd. male 38—40, female 37—38; h. w. male 30—32, female 32—33.

Male.—Metallic blue or green, resembling *maculata* in the white and black markings. The abdomen, however, is more slender and somewhat longer. Wings yellowish hyaline, darkened to black on the apical third or fourth.

Female.—Abdomen green, brown toward tip. Wings apically lighter. Pterostigma narrow, white, not reticulated.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee, Co.; Milwaukee River, July, 1899, July 8, 1902; Vilas Co., Divide, June 24—30, 1907; Washington Co., Little Cedar Lake, Aug. 1—15, 1907.

Time and Habitat—June to August at river shores.

Calopteryx dimidiata Burmeister, Handbuch der Ent., 2, p. 529, 1839; Idem, 2, p. 827, 1839 (*C. apicalis* Burm.); Hagen, Syn. Neur.

N. Am., p. 57, 1861; Needham, Bull. 68 N. Y. State Mus., p. 223, 1903 (Bibliography).

Abd. male 36, female 34; h. w. male 28, female 30.

Male.—Metallic green and blue. Thorax with black on the lateral sutures, yellow below. Rear of head with a tubercle each side. Wings yellowish hyaline, the apical fifth or sixth fuscous to black.

Female.—Similar. Apices of wings brown, fainter in the hind wings. Pterostigma varying in size, white, reticulated.

Life Zone: Upper and Lower Austral.

Wisconsin: Dane Co., June, 1890; Milwaukee Co., June 12, 1896; Washington Co., Little Cedar Lake, Aug. 1-15, 1907.

Time and Habitat—Over rippling waters June to August.

HÆTERINA Hagen, Syn. Cal., p. 30, 1853, Syn. Neur. N. Am., p. 58, 1861; Needham, Proc. U. S. Nat. Mus., 26, p. 745, 1903 (Venation).

The species of this genus have similar habits to those of the preceding. Like the species of *Calopteryx* they frequent the sunny ripples of quick-flowing streams. The fauna of Wisconsin contains but one species, though it is likely that a second may be found in the extreme southern parts of the state. Other species are found only in the south. The two northern species are separable by the following differential characters:

1. Males.—Base of all wings red; tibiae yellow externally. **americana**
Base of hind wings brown, apices dark; tibiae black. **tricolor**
2. Females.—Wings flavescent at base and along costa; tibiae yellow externally. **americana**
Wings flavescent throughout; tibiae entirely black. **tricolor**

Hæterina americana Fabricius, Ent. Syst. Suppl., p. 287, 1798; Hagen, Syn. Neur. N. Am., p. 60, 1861; Needham, Bull. 68 N. Y. State Mus., p. 226, 1903 (Bibliography & Decs. of nymph).

Abd. male 34—38, female 32—33; h. w. male 28—30, female 30—31.

Male.—Is characterized by the color of the wings, bright red at the basal fourth, copper colored in young specimens, the coppery head and thorax, and dull green abdomen, with basal rings of white on each segment.

Female.—Wings flavescent basally and along costa, sometimes throughout the extent of the wing. Thorax and head green, abdomen green dorsally, with a linear mid-dorsal stripe and rings on the abdominal joints white. Body yellow beneath.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Dane Co., July 1900; Milwaukee Co., Sept. 1, 1901, July 8, 1902, June 14, July 10-27, 1903; Waupaca, Aug. 15, 1902.

Time and Habitat—June to September near quick-flowing streams, and small rapids.

FAMILY AGRIONIDÆ.

SUB-FAMILY AGRIONINÆ.

This group comprises eight genera for our northern life areas, including therein the smallest damselflies known to our fauna.

Tropical genera, however, show really gigantic forms, measuring in expanse of wing from 5—8 inches. The habits of our northern representatives are similar to those of the preceding subfamily. They seek the low sedges of river bottoms and beaches in search of food or unwary mates; for, small as they are, they are said to be cannibalistic to a great extent. Small, but graceful fliers, they are varied in color, some dull green, some a beautiful violet, others priding a mixture of red, green and orange.

- | | |
|--|---------------------|
| 1. Median and submedian sectors arising near the nodus..... | 2 |
| Median and submedian sectors arising near the arculus..... | Lestes |
| 2. Spines of the tibiae short..... | 3 |
| Spines of the tibiae twice as long as the spaces between them.. | Argia |
| 3. No postocular spots..... | 4 |
| Postocular spots present..... | 5 |
| 4. Colors blue and black..... | Erythromma |
| Colors red and black..... | Amphiagrion |
| 5. Pterostigma of front and hind wings similar..... | 6 |
| Pterostigma of front and hind wings dissimilar in color; an apical bifid process on dorsum of 10..... | 7 |
| 6. Nodal sector arising near the fourth postcubital on fore wing, near the third on hind wing; abdomen about 20 mm.. | Nehalennia |
| Nodal sector arising near the fifth postcubital on fore wing, near the fourth on hind wing; abdomen about 25 mm.. | Enallagma |
| 7. Pterostigma of fore wings normal, darker than of hind wing.. | Ischnura |
| Pterostigma of fore wings removed from costa, lighter than of hind wing..... | Anomalagrion |

The foregoing table accounts only for the generic characters of the males. The females, especially of the three last genera enumerated, are so vitally different from the males, even structurally, that it is well-nigh impossible to bring them under a uniform arrangement with the males. For that reason I have compiled a separate one for the females. *Lestes* and *Argia* are omitted, since the females of these genera distinguish themselves sufficiently from all others, *Lestes* by the venation, and *Argia* by the armature of the tibiae.

- | | |
|--|---------------------|
| 1. Bristles of the tibiae short; no apical spine on sternum of 8.... | 2 |
| Bristles of the tibiae short; an apical spine on sternum of 8.... | 3 |
| 2. No postocular spots; colors blue and black; length of abdomen about 28 | Erythromma |
| Postocular spots present; colors bronzy green; slender species, length of abdomen about 20..... | Nehalennia |
| 3. Postocular spots present..... | 4 |
| No postocular spots; colors red and black..... | Amphiagrion |
| 4. Nodal sector arising near the fourth postcubital on the fore wing, near the third on the hind wing..... | 5 |
| Nodal sector arising near the fifth postcubital on the fore wing, near the fourth on the hind wing..... | Enallagma |
| 5. Less than three basal segments of abdomen orange..... | Ischnura |
| Four basal segments orange or yellow..... | Anomalagrion |
- LESTES** Leach. Edin. Encyl., 9, p. 137, 1816; Needham, Broc. U. S. Nat. Mus., 26, p. 710, 717, 720, 1903 (Venation).

The species of this genus have their habitat usually near standing waters, though they are also met with in woods flying among the low foliage of bushes. Nine species inhabit the northern life areas, seven of which are resident in the state. It is possible that the two others may also be found in Wisconsin, but they have not been recorded thus far. The species group themselves naturally in three series according to the relative length of the superior and inferior appendages of the male.

- A. Inferior appendages less than half the length of the superiors
.....**eurinus & congener**
- B. Inferiors more than half the length of the superior appendages 1
1. Male inferior appendages straight, the apex dilated, or not
so 2
Male superior appendages sigmoid.....**unguiculatus**
 2. Thorax metallic green, carina and humerals, if yellow, very
narrow 3
Thorax brownish 4
 3. Abdomen less than 34 mm. in length.....**uncatus**
Abdomen more than 34 mm. in length.....**vigilax**
 4. Abdomen very long and slender, about 40 mm.....**rectangularis**
Abdomen shorter, brighter than thorax.....
.....**disjunctus & forcipatus**
- C. Inferiors longer than superiors, incurved; rear of head in both
sexes yellow.....**inaequalis**
The females of group B may be separated, as follows:
1. Rear of head blackish..... 2
Rear of head with a yellow band.....**unguiculatus**
 2. Thorax green 3
Thorax brownish..... 4
 3. Basal half of segment 1 of abdomen yellow.....**uncatus**
Segment 9 & 10 largely yellow.....**vigilax**
 4. Pterostigma black..... 5
Pterostigma brown.....**disjunctus**
 5. Basal rings on 3—7 interrupted on dorsum.....**forcipatus**
Basal rings on 1—6 not interrupted on dorsum, narrow.....
.....**rectangularis**

Lestes eurinus Say, Journ. Acad. Sci. Phila., 8, p. 36, 1839; Hagen, Syn. Neur. N. Am., p. 70, 1861; Needham, Bull. 68, N. Y. State Mus., p. 233, 1903 (Bibliography & Desc. of nymph).

Abd. male and female 38; h. w. male 28, female 30.

Male.—Dark metallic green. Thoracic carina and humerals black, sides of thorax and beneath, sides of abdomen and basal rings on 3—7, yellow.

Female.—Mid-dorsal thoracic carina yellow. The species is readily distinguished from all others by its size and the slightly flavescent wings.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., July 17, 1902; Western Wisconsin.

Time and Habitat—June to August about stagnant pools.

Lestes unguiculatus Hagen, Syn. Neur. N. Am., p. 70, 1861; Needham Bull. 68, N. Y. State Mus., p. 235, 1903 (Bibliography & Desc. of nymph).

Abd. male 30, female 28; h. w. male 20, female 21.

Male.—Color dull black, with a brown tinge, markings yellow. The body below yellow. Abdomen green, sides of 1—7 and narrow basal rings interrupted on the dorsum, yellow. Stigma brown, bounded at each end by a fine white line.

Female.—Humeral wider, and more yellow on sides of thorax and abdomen. Rear of head with a yellow band.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., 1900; July 27, 1903.

Time and Habitat—July to October about lakes and ponds.

Lestes uncatus Kirby, Synonymic Catalogue, p. 160, 1890; Needham, Bull. 68 N. Y. State Mus., p. 234, 1903 (Bibliography & Desc. of nymph).

Abd. male 20, female 27; h. w. male 21, female 25.

Male.—Color metallic green, marked with yellow. Thorax green, with a narrow humeral line yellow. Abdomen with three apical segments black, narrow rings on 3—7 at the joints, and sides largely, yellow.

Female.—A mid-dorsal thoracic carina yellow. Abdominal rings interrupted on dorsum, basal half of segment 1 yellow.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., May 30, 1900; Milwaukee Co., Aug. 12, 1900; July 10-22, 1903.

Time and Habitat—July to September about small lakes and ponds.

Lestes disjunctus Selys, Bull. Ac. Belg. (2), 13, p. 302, 1862; Needham, Bull. 68, N. Y. State Mus., p. 233, 1903 (Bibliography).

Abd. male 29, female 27; h. w. male 20, female 21.

Male.—Color dull black, marked with yellow. Abdomen green or bronze, the three apical segments black. Sides of 1—7 yellow, 3—7 with narrow interrupted basal rings. Thoracic carina and narrow humerals, yellow.

Female.—Abdomen stouter, humerals wider than those of the male.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., Aug. 22, 1899.

Time and Habitat—July to September about small lakes and rivers.

Lestes forcipatus Rambur, Ins. Nev., p. 246, 1842; Hagen, Syn. Neur. N. Am., p. 70, 1861 (*L. hamata*); Needham, Bull. 68 N. Y. State Mus., p. 235, 1903 (Bibliography & Desc. of nymph).

Abd. male 33, female 29—31; h. w. male 22, female 24.

The male and female of this species both resemble *disjunctus* very much. The male is distinguished by the wider humerals and apically wider inferior appendages, the female by her coloration and markings agreeing closely to those of the male and the black stigma.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., July 9, 1899.

Time and Habitat—April to August about rivers and small lakes.

Lestes rectangularis Say, Journ. Ac. Sci. Phila., 8, p. 34, 1839; Hagen, Syn. Neur. N. Am., p. 66, 1861; Needham, Bull. 68 N. Y. State Mus., p. 235, 1903 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus., 26, p. 762, 1903 (Venation).

Abd. male 39—41, female 32—34; h. w. male 21—25, female 23.

Male.—Dull brown, nearly black, marked with yellow or green.

Face and thoracic stripes yellow or green. Abdomen greatly attenuated, segments 1—5 light brown basally, black apically, the black forming distinct apical rings; 6—10 black; 1—7 with narrow rings at the joints.

Female.—Abdomen shorter, stout, bronze on dorsum, basal rings on 1—7.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., July 17, 1900, Aug. 4, 1901, July 17-Aug. 24, 1903, Aug. 21, 1904, Aug. 3, 1907.

Time and Habitat—June to September near banks of rivers, in woods and swampy thickets.

Lestes vigilax Hagen, Bull. Ac. Belg. (2), 13, p. 306, 1862; Needham, Bull. 68 N. Y. State Mus., p. 235, 1903 (Bibliography).

Abd. male 40, female 26; h. w. male 25, female 26.

Male.—Color metallic green, marked with yellow. Thoracic stripes yellow or pale green. Abdomen green, apical segments dull, sides of 1—5, and part of 6 yellow. Basal segments with a narrow basal ring of yellow, and a subapical one of black. Stigma of both sexes yellow.

Female.—Like male. Humeral stripes wider, and segments 9—10 of abdomen largely yellow.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., 1900, June 29-July 27, 1903; Nago-wicka Lake, July 26, 1902; Waukesha, July 1902. Next to *rectangularis* our commonest species.

Time and Habitat—July to September about the marshy shores of lakes and ponds.

ARGIA Rambur, Ins. Nev., p. 254, 1842; Calvert, Bull. Mus. Comp. Zool., 39:4, p. 105, 1902 (Bibliography); Needham, Proc. U. S. Nat. Mus., 26, p. 710, 727, 1903 (Venation).

A large genus of small species, numbering in all about 65, the majority of which are found in North and South America. The imagos frequent chiefly the rank vegetation of swamps and marshy places, but a few of them are sun-loving and fly in open places. Two species have thus far been taken in the state, but a third can be expected with some certainty. Species of the Upper Austral areas may be identified according to the following table:

MALES.

- | | |
|--|-------------------|
| 1. Stigma above more than a single cell..... | 2 |
| Stigma above not more than a single cell..... | 3 |
| 2. Apical segments of abdomen black..... | putrida |
| Apical segments 8—9 with the basal half blue..... | translata |
| 3. Wings clear, or faintly tinged at the apices..... | 4 |
| Wings entirely smoky brown..... | fumipennis |
| 4. Segments 1—7 ringed with, and 8—10 entirely blue..... | 5 |
| Segments 2—7 black, 9—10 blue..... | tibialis |
| 5. Abdominal segments 1—7 largely blue..... | 6 |
| Abdominal segments 1—7 largely black..... | 7 |
| 6. Thorax violet, humeral black, bifid above, not wider than the antehumeral | violacea |

- Thorax deep blue, humeral black, not bifid above, wider than the antehumeral.....*bipunctulata*
 7. Thorax deep blue, stripes heavy and broad.....*sedula*
 Thorax light blue, stripes slight, obscure.....*apicalis*

FEMALES.

1. Wings colored..... 2
 Wings clear..... 3
2. Wings flavescent.....*sedula*
 Wings smoky brown.....*fumipennis*
3. Segment 9 with some black..... 4
 Segment 9 entirely yellow or blue..... 5
4. Basal half of 9 black.....*apicalis*
 Segment 9 entirely black.....*tibialis*
5. Segment 7 dark, 8—10 yellow or blue; abdomen 25 mm.....*violacea*
 Segment 8 dark, 9—10 yellow or blue; abdomen 32 mm.....*putrida*

Argia putrida Hagen, Syn. Neur. N. Am., p. 96, 1861; Needham, Bull. 68 N. Y. State Mus., p. 240, 1903 (Bibliography & Descs. of nymph); Hagen & Calvert, Bull. Mus. Comp. Zool., 39, p. 122, 1902 (Bibliography & Figure).

Abd. male and female 32; h. w. male and female 25.

Male.—Color gray or blackish. Dorsum of thorax and a lateral stripe black. Abdomen black, 3—7 with light basal rings.

Female.—Brown and black. Abdomen brown above with a lateral black stripe on each segment. Stigma of both sexes covering more than one cell, that is, one cell and part of the next.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Milwaukee Co.; June 3-16, 1899, July 6-Aug. 8, 1902, July 1-Aug. 18, 1901, July 7-Aug. 17, 1903.

Time and Habitat—Shores of lakes and rapid streams May to September.

Argia violacea Hagen, Syn. Neur. N. Am., p. 90, 1861; Hagen & Calvert, Bull. Mus. Comp. Zool. 39, p. 116, 1902 (Bibliography & Figure); Needham, Bull. 68 N. Y. State Mus., p. 242, 1903 (Bibliography & Descs. of nymph).

Abd. male and female 25—26; h. w. male 20, female 21.

Male.—Violet. Thoracic stripes black, the humeral bifid above. Abdomen violet, apical rings on 2—6, and 7 entirely, black; 8—10 blue.

Female.—Brown or dull violet. Abdomen brown, lateral spots extending upward, interrupted on dorsum.

Life Zone: Transition and Upper Austral.

Wisconsin: Nagawicka Lake, Aug. 29, 1901; Waupaca, Aug. 15, 1903; Milwaukee Co., July 1-6, 1902, July 1-15, 1903.

Time and Habitat—June to September about large ponds and slow streams.

Argia apicalis Say, Jour. Ac. Sci. Phila., 8, p. 40, 1839; Hagen, Syn. Neur. N. Am., p. 91, 1861; Hagen & Calvert, Bull. Mus. Comp. Zool. 39, p. 106, 1902 (Bibliography & Figure); Needham, Bull. 68, N. Y. State Mus., p. 242, 1903 (Bibliography & Desc. of nymph).

Abd. male 29, female 28; h. w. male 21, female 23.

Male.—Color pale blue. Vertex, thoracic carina, humeral, suture

above and below, black. Abdomen dark brown or black, 3—7 with narrow pale basal rings, 8—10 blue.

Female.—Brown or blue. Abdomen with dorsum black, 10 and half of 9 blue.

Life Zone: Transition and Upper Austral.

Time and Habitat—June to September about shaded ponds and shores of streams.

NEHALLENNIA Selys, *Revue Odonates d'Eur.*, p. 172, 1850; Needham, *Proc. U. S. Nat. Mus.*, 26, 710, 727, 1903 (Venation).

Of this genus three species occur in the United States. They fly among the low sedge of river-banks, along sheltered brooks, often in thick masses. But one species, *irene*, has been taken in the State, though a second, *posita*, is known to occur westward as far as Missouri and is likely to be found in Wisconsin, probably in the western portion of the state. The species are separated by their colors and the form of the posterior lobe of the prothorax.

MALES.

1. Colors blue and green..... 2
- Colors bronze, black and yellow..... **posita**
2. Abdomen with 8—10 blue, with lateral green triangles..... **irene**
- Abdomen with 8—10 blue, with a black basal ring on 8.... **gracilis**

FEMALES.

1. Posterior lobe of prothorax emarginate..... 2
- Posterior lobe of prothorax rounded, medially produced..... **posita**
2. Posterior lobe of prothorax notched once..... **gracilis**
- Posterior lobe of prothorax notched twice..... **irene**

Nehalennia irene Hagen, *Syn. Neur. N. Am.*, p. 74, 1861; Needham, *Bull. 68, N. Y. State Mus.*, p. 249, 1903 (Bibliography & Desc. of nymph); Needham, *Proc. U. S. Nat. Mus.*, 26, p. 764, 1903 (Venation).
Abd. male and female 21; h. w. male 13, female 14.

Male.—Color green, marked with blue, yellow below. Abdomen with pale basal rings on 1—6, interrupted on dorsum of 3—6, basal half of 9 and apex of 8 blue, with lateral green tri- or rectangles. Inferior appendages longer than superiors.

Female.—Differs from the male by having the 8th segment green. The blue is limited to 10 and an apical spot on 9.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., June 16, 1899, July 17, 1902, June 14, 1903.

Time and Habitat—May to July about quiet waters.

AMPHIAGRION Selys, *Bull. Ac. Belg.* (2) 41, p. 284, 1876.

A single species is found in Wisconsin.

Amphiagrion saucium Burmeister, *Handbuch der Ent.*, 2, p. 819, 1839 (*discolor & saucium*); Hagen, *Syn. Neur. N. Am.*, p. 79 & 85, 1861; Williamson, *Ent. News*, 11, p. 454, 1900 (*abbreviatum*); Needham, *Bull. 68, N. Y. State Mus.*, p. 247, 1903 (Bibliography & Desc. of nymph).

Abd. male 20, female 21; h. w. male 14, female 15.

Male.—Thorax and apical segments of abdomen black, basal segments red. Abdomen with narrow basal pale rings on 1—7, and inter-

rupted sub-apical black rings till 6, plainest toward the apical segments; 7 mostly black, 8—10 black with narrow red rings and sometimes a mid-dorsal red stripe.

Female.—Thorax brown. Apical segments of abdomen brown or black with the mid-dorsal stripe more distinct.

Life Zone: Transition and Upper Austral.

Wisconsin: Waukesha Co., June 15, 1902; Milwaukee Co., June 22—July 6, 1902, June 14, 1903.

Time and Habitat—May to July in grasses of lakes and river-banks.

ENALLAGMA Charpentier, Lib. Neur., p. 21, 1840; Needham, Proc. U. S. Nat. Mus., 26, p. 720, 1903 (Venation).

Most of our brightly colored damsel-flies flitting about the lakes, ponds and rivers in the early summer months belong to this genus. They are prettily colored, some blue, green and black, especially on the abdominal segments, others are mainly orange and yellow, varied with black, or blue on some segments of the abdomen. The considerable variation in color and extent of the markings make them quite difficult to determine. In the males, however, this difficulty is obviated by the sufficiently characteristic abdominal appendages. But the females, because of the great similarity of the species, tax the student's ingenuity to the utmost, and even then, in cases like *carunculatum* and *civile*, there is no absolute certainty of specific values. Certainty in such cases can only be had when the female is caught with the male. The following table, based on colors, refers only to males.

1. Dorsum of segment 2 of abdomen blue with an apical spot black	2
Dorsum of segment 2 black.....	14
2. Dorsum of segment 3—5 at least one third blue.....	3
Dorsum of segment 3—5 mostly black.....	11
3. Segment 5 more than half blue.....	4
Segment 5 with blue and black about equal.....	<i>carunculatum</i>
4. Apical two thirds of 6 black.....	5
Apical third of 6 black.....	<i>hageni</i>
5. Superior appendages simple, cylindrical.....	6
Superior appendages bifid.....	8
6. Inferiors longer than superiors.....	7
Inferiors not longer than superiors, strongly upcurved.....	<i>durum</i>
7. Superiors with an apical recurved lobe.....	<i>annexum</i>
Superiors with an apical tubercle.....	<i>calverti</i>
8. Superiors with an introduced tubercle between the branches...	9
Superiors without an introduced tubercle between the branches	10
9. Branches of the superior appendages equal.....	<i>ebrium</i>
Branches unequal, the upper shorter than the lower...	<i>doubledayi</i>
10. Tubercle equal in size to the branches.....	<i>civile</i>
Tubercle reduced, much smaller than the branches.....	<i>anna</i>
11. Sides of segment 2 blue.....	12
Sides of segment 2 with a black spot.....	<i>geminatum</i>

- | | |
|---|--------------------|
| 12. Segment 8 entirely blue..... | 13 |
| Segment 8 with a black basal spot..... | traviatum |
| 13. Segment 7 with a basal ring of black..... | aspersum |
| Segment 7 entirely black..... | piscinarium |
| 14. Thorax green or blue, and black..... | 15 |
| Thorax orange or yellow, and black..... | 17 |
| 15. Dorsum of 8 black..... | 16 |
| Dorsum of 8 blue..... | divagans |
| 16. Face green or blue..... | exsulans |
| Face yellow or orange..... | antennatum |
| 17. Segment 9 yellow..... | signatum |
| Segment 9 blue..... | pollutum |

A further table refers exclusively to the females of such species that have been taken in Wisconsin or are likely to be found. As supreme criterion I selected the form of the posterior lobe of the prothorax, which seems to be a quite constant character. Accordingly the species are divided into three groups, each group subdivided according to colors of the thorax and the abdomen. Even so the grouping is only tentative and may not be practical, since little latitude is permissible in a table as regards the darkened colors of aging specimens:

Group 1: *Prothorax with posterior lobe rounded.*

- | | |
|--|---------------------|
| (a) Thorax yellowish green and black; dorsum of abdomen black. | |
| Segments 3—7 with pale basal interrupted rings..... | civile |
| (Not distinguishable from civile)..... | carunculatum |
| (b) Thorax yellowish green and black; dorsum of abdomen green basal rings on 2—7 pale..... | ebrium |
| (c) Thorax blue and black; abdomen black..... | |
| Segment 8 with a mid-dorsal black spot..... | calverti |
| Segment 8 with a lateral blue spot..... | geminatum |
| (d) Thorax green and black; abdomen black dorsally. | |
| Segments 3—7 with pale basal rings..... | hageni |
| (e) Thorax orange and green; dorsum of abdomen black, yellow or blue. | |
| Segment 9 with black ascending to mid-dorsal apex..... | signatum |
| Segment 9 apically, 10 entirely yellow or blue..... | pollutum |

Group 2: *Prothorax with posterior lobe laterally sub-excised.*

- | | |
|---|-----------------|
| (a) Thorax blue and black; dorsum of abdomen black. | |
| Dorsal stripe narrowed on 7—8..... | aspersum |

Group 3: *Prothorax with a tubercle on the posterior lobe.*

- | | |
|--|-------------------|
| (a) Thorax green and orange; dorsum of abdomen green. | |
| Segment 10 and apex of 9 blue..... | exsulans |
| (b) Thorax green and orange; dorsum of abdomen black, with yellow or blue. | |
| Segment 10 mostly blue..... | antennatum |

Enallagma carunculatum Morse. Psyche, 7, p. 19, 1895; Needham, Bull. 68, N. Y. State Mus., p. 255, 1903 (Bibliography & Desc. of nymph). Abd. male 25, female 26; h. w. male 19, female 20.
Male.—Color blue, with black markings. Abdomen blue, an apical

spot on 2, apical third of 3, half of 4 and 5, apical two thirds of 6, most of 7 and 10 black. Appendages straight, cylindrical, the superiors with an introduced tubercle.

Female.—Resembles *civile* so closely that it is impossible to distinguish the two from each other.

Life Zone: Boreal to Upper Austral.

Wisconsin: Dane Co., 1900; Delafield, Aug. 1902; Cedar Lake, Aug. 12, 1902; Waupaca, Aug. 15, 1903.

Time and Habitat—June to September about lakes and streams.

Enallagma hageni Walsh, Proc. Ent. Soc. Phila., 2, p. 234, 1863; Needham, Bull. 68 N. Y. State Mus., p. 234, 1863 (Bibliography & Desc. of nymph).

Abd. male 23, female 22; h. w. male 16, female 17.

Male.—Color blue, with black markings. Thorax with a mid-dorsal and humeral stripes black. Abdomen blue, basal spot on 1, apical spot on 2, apical third of 3—5, half of 6, most of 7 and all of 10, black.

Female.—Green. Dorsum of abdomen black, 3—7 with pale basal rings.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., June 1890; Milwaukee Co., July 1900; July 22, 1902; Waupaca, Aug. 15, 1903; Door Co.: Plum Island, July 6, 1905; Portage Co., Aug. 26, 1905; Divide, June 24-30, 1907; Washington Co.: Little Cedar Lake, July 29, 1907.

Time and Habitat—May to August at shores of lakes and streams.

Enallagma calverti Morse, Psyche, 1895; Williamson, Ent. News, 11, p. 455, 1900.

Abd. male 23—26, female 24—26; h. w. male 19—21, female 20.

Male.—Color bright blue. Face blue. Occipital spots large. Carina, and humerals black. Below paler blue. Abdomen blue; a basal spot on 1, a sub-apical spot on 2, a fine basal ring on 3, larger apical rings on 3—5, two thirds of 6, 7 entirely but for a narrow basal area, black. In markings this species agrees with *annexum*, differing by the rounded superior appendages.

Female.—Blue, with a greenish lustre. Thorax with markings like the male dorsum of abdomen black, pale basal rings on 3—7, interrupted on 3, 8 pale with a median spot, the black narrowing on 9 and 10 to an apical point on 10.

Life Zone: Boreal and Transition.

Wisconsin: Milwaukee Co., June 22, 1902.

Time and Habitat—May to July in moist woods and along shaded streams.

Enallagma ebrium Hagen, Syn. Neur. N. Am., p. 89, 1861; Needham, Bull. 68 N. Y. State Mus., p. 255, 1903 (Bibliography).

Abd. male 25, female 24; h. w. male 17, female 18.

Male.—Color blue, markings much like *hageni* and *civile*. From these two it differs mainly in the form of the superior appendages. *Hageni* has a slight notch apically on the superiors, *ebrium* has two equal branches.

Female.—Abdomen entirely dark green, with pale basal rings on 2—7.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June 22, 1902.

Time and Habitat—June to August at shores of streams.

Enallagma civile Hagen, Syn. Neur. N. Am., p. 88, 1861; Needham, Bull. 68 N. Y. State Mus., p. 256, 1903 (Bibliography).

Abd. male 25, female 27; h. w. male 18, female 20.

Male.—Markings like *ebrium*. The superior appendages have an introduced tubercle.

Female.—Dull blue or yellowish green, dorsum of abdomen black, 3—7 with pale interrupted rings.

Life Zone: Boreal to Lower Austral.

Wisconsin: Near Southern Boundary.

Time and Habitat—May to September about lakes and ponds.

Enallagma aspersum Hagen, Syn. Neur. N. Am., p. 97, 1861; Needham, Bull. 68 N. Y. State Mus., p. 256, 1903 (Bibliography).

Abd. male 25, female 24—25; h. w. male and female 18.

Male.—Color blue, marked with black. Abdomen blue; a basal spot on 1, an apical spot on 2, apical two-thirds of 3, all of 4—6, basal half of 7, and 10 entirely, black. Segments 4—6 have narrow basal interrupted rings.

Female.—A trifle lighter, dorsum of abdomen black, interrupted rings on 3—7.

Life Zone: Upper Austral.

Time and Habitat—June to August about lakes and streams.

Enallagma exulans Hagen, Syn. Neur. N. Am., p. 97, 1861; Needham, Bull. 68 N. Y. State Mus., p. 255, 1903 (Bibliography & Desc. of nymph).

Abd. male 27, female 26; h. w. male 18, female 19.

Male.—Color blue. Thorax with black mid-dorsal and humerals. Abdomen black, blue ringed; on 1 apically, basal and interrupted on 3—6; 10 and apex of 9 blue.

Female.—Dorsum of abdomen green, interrupted basal rings on 3—6; 10 and apex of 9 blue.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., July 6-8, Aug. 8, 1902.

Time and Habitat—May to September at shores of lakes and streams.

Enallagma antennatum Say Journ. Ac. Sci. Phila. 8, p. 39, 1869; Hagen, Syn. Neur. N. Am., p. 73, 1861; Needham, Bull. 68 N. Y. State Mus., p. 257, 1903 (Bibliography & Desc. of nymph).

Abd. male 24, female 23; h. w. male 17, female 18.

Male.—Colors blue, marked with black, yellow and green. Thorax black, with carina and humerals yellow, sides yellow or pale blue to green. Dorsum of abdomen black, an apical ring on 1, narrow basal interrupted rings on 3—6, and 9 entirely, blue.

Female.—Thorax similar to male. Abdomen black, interrupted rings on 3—6, and most of 10 blue.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., June 29, 1903; Nagowicka Lake, Aug. 8-20, 1901; Cedar Lake, Aug. 12, 1901.

Time and Habitat—May to September about lakes, ponds and streams.

Enallagma signatum Hagen, Syn. Neur. N. Am., p. 84, 1861; Needham, Bull. 68 N. Y. State Mus., p. 258, 1903 (Bibliography & Desc. of nymph).

Abd. male 28, female 27; h. w. male 17, female 18.

Male.—Color orange, marked with green and black. Thorax with black carina and humerals, also a stripe on the second lateral suture. Dorsum of abdomen black, an apical ring on 1, basal interrupted rings on 3—7, 9 and sides of 10 yellow.

Female.—Thorax orange and green. Abdomen like male. 10 entirely yellow.

Life Zone: Transition and Upper Austral.

Wisconsin: Little Cedar Lake, July 29, 1907.

Time and Habitat—June to September in reeds of lake shores.

Enallagma pollutum Hagen, Syn. Neur. N. Am., p. 83, 1861; Needham, Bull. 68 N. Y. State Mus., p. 258, 1903 (Bibliography).

Abd. male and female 28; h. w. male 17—18, female 18.

Male.—Color bright yellow to orange. Thorax yellow, mid-dorsal stripe wide, green, humeral narrow, often indicated only by a spot on the suture above and below. Dorsum of abdomen green, darker apically on the segments. Pale interrupted basal rings on 3—7, 9 and 10 blue, the appendages yellow.

Female.—Dorsum of abdomen black, interrupted rings on 3—7, apex of 9 and 10 entirely yellow or blue.

Life Zone: Transition, Upper and Lower Austral.

Wisconsin: Little Cedar Lake, July 29-Aug. 15, 1907.

Time and Habitat—June to September in reeds of lake shores.

ISCHNURA Charpentier, Lib. Eur., p. 20, 1840.

A single species of this genus has been found in Wisconsin. The male imagoes resemble some of the *Enallagma* with their markings. The female is considered dimorphic, two distinct color types are found, often in the same brood.

Ischnura verticalis Say Journ. Ac. Phila., 8:37, 1839; Hagen, Syn. Neur. N. Am., p. 76 & 82, 1861; Kirby, Synonymic Cat., 1890; Needham, Bull. 68 N. Y. State Mus., 261, 1903 (Bibliography & Desc. of nymph).

Abd. male 20, female: black 21, orange 22; h. w. male 13, female: black 14, orange 15.

Male.—Green, postocular spots blue. Mid-dorsal and humeral stripes wide and black. Dorsum of abdomen black, pale rings apically on 1, basally and interrupted on 3—7, 8 and 9 bright blue with black lateral stripes. Pterostigma of front wings black, of hind wings pale brown.

Black female.—Like males. Abdomen black, sides paler, segments darker apically. Pterostigma light brown or yellow on all wings.

Orange female.—Orange and black. Face and occipital spots orange, vertex black. Thorax with mid-dorsal stripe wide, black, the humeral narrow, linear. Abdomen with first three segments orange, segments 4—10 black. Segment 3 has a fine basal and a wider apical ring. The amount of black on the three orange segments is varied. Segment 1 often has a dorsal basal linear spot. Some specimens have also an apical spot on 2. The amount of black on the apex of segment 3 is quite variable, extending over one-fourth to one-half of the segment. A linear stripe is sometimes evident on the dorsum of the first three segments.

Life Zone: Transition, Upper and Lower Austral areas.

Wisconsin: Lake Nagowicka, Aug. 20, 1901; Delafield, Aug. 20, 1902; Waupaca, Aug. 15, 1903; Milwaukee Co., June 22, July 1, 17, Aug. 8, 1902. June 6, 14, 29, July 17, 1903.

Time and Habitat—May to October near water, in woods and open places.

SUB-ORDER ANISOPTERA.

FAMILY AESCHNIDÆ.

SUB-FAMILY CORDULEGASTERINÆ.

A single genus is placed with this sub-family. Little is known of the habits of the species; they are said to frequent ravines, gulleys and gorges, and have been taken sparingly by collectors. Six species are found in the east, and a seventh is regional to the north-west.

CORDULEGASTER Leach, Edin. Encycl. 9, p. 136, 1815; Needham, Proc. U. S. Nat. Mus., 26, w. 719, 732, 750, 1903 (Venation).

The following tabella includes both males and females:

- | | |
|--|-------------------|
| 1. Abdomen with mid-dorsal spots..... | 2 |
| Abdomen with lateral spot..... | 3 |
| Abdomen with yellow half-rings on the segments..... | 5 |
| 2. Spots bifid..... | <i>dorsalis</i> |
| Spots hastate..... | <i>obliquus</i> |
| 3. Length of abdomen less than 60 mm..... | 4 |
| Length of abdomen more than 60 mm. (65)..... | <i>fasciatus</i> |
| 4. A single lateral spot on each segment..... | <i>diastatops</i> |
| A median and an apical lateral spot on the middle segments.. | <i>maculatus</i> |
| 5. Face yellow..... | <i>sayi</i> |
| Face blackish..... | <i>erroneus</i> |

Cordulegaster obliquus Say, Journ. Ac. Sci. Phila. 8, p. 15, 1839; Hagen, Syn. Neur. N. Am., p. 116, 1861.

Abd. male 52, female 54; h. w. male 44, female 47.

Male and female.—Brown or yellow and black. Face yellow, a black band across the middle. Thorax black, two short yellow divergent stripes on the dorsum, and two longer yellow stripes each side of the thorax margined in black. Abdomen black, a spot on 1, a stripe on 2, hastate spots on 3—8, a small basal spot on 9, yellow. The spots decrease in size toward the apex.

Life Zone: Upper Austral.

Wisconsin: Waukesha, June 9, 1902.

Time and Habitat—May to August near lakes.

Cordulegaster sayi Selys, Mon. d'Odon. 19, p. 331; Hagen, Syn. Neur. N. Am., p. 115, 1861.

Abd. male and female 45; h. w. male and female 41.

Male and female.—Color black, marked with yellow. Face yellow, a black band across the middle. Thorax with two yellow divergent stripes on the dorsum, and two lateral stripes also yellow, but longer and wider. Abdomen black, the segments with yellow half-rings.

Life Zone: Transition and Upper Austral.

Upper Wisconsin.

Time and Habitat: June to August about lakes.

SUB-FAMILY PETALURINAE.

A single genus, *Tachopteryx*, is included in this sub-family. But few species are known, four in all, one of which is found in the Union. Its range is eastern and southern. The imagoes resemble the Gomphidæ, though they are readily distinguished from all other genera by the bifid median lobe of the labium. Also, the females of *Tachopteryx* have an ovipositor.

SUB-FAMILY GOMPHINAE.

The species of this group include many of our large bulky dragon-flies. They are strong fliers, but somewhat eccentric, though their wings are well able to bear them. The markings of the body consist of olive, yellow, and black stripes. They frequent flowing or clear water. The nymphs are predatory in habit; they burrow in the sand or mud in ambush, aided by their protective coloration, or hide among the reeds, till their prey appears. They attack by a sudden extension of the labium, seizing their victim with the claw-like lateral labial hooks. The following key comprises the genera found in temperate zone. *Herpetogomphus* has been eliminated, since its proper life zone is tropical. It has been found regionally in some parts of Arkansas and Texas, but never east of the Mississippi.

1. No basal cross-vein; legs long, hind femora passing base of segment 2 2
 Basal sub-costal cross-vein present; legs short, hind femora hardly reaching base of segment 1.....**Progomphus**
2. Hind wing with anal loop..... 3
 Hind wing without anal loop..... 4
3. Triangles free; anal loop of three cells; stigma broad with convex sides**Ophiogomphus**
 Triangles crossed; anal loop of four cells; stigma narrow, with parallel sides.....**Hagenius**
4. Triangle of fore wing less than one fourth shorter than of hind wing..... 5
 Triangle of fore wing one third shorter than of hind wing.**Lanthus**
5. Hind femora reaching to middle of segment 2, armed with numerous short spines.....**Gomphus**
 Hind femora reaching to base of 3; armed with numerous short and a row of strong prominent spines.....**Dromogomphus**

PROGOMPHUS Selys. Ac. Bull. Belg. 21 (2), p. 69, 1854.

A single species of this genus is found in temperate America. *P. obscurus*. The life Zone of this species appears to be the Upper Austral, and it can be expected in the Southern portions of Wisconsin.

HAGENIUS Selys, Bull. Ac. Belg. 21 (2), p. 1854.

A genus of two species, one from Tonkin, the other from the U. S. *H. brevistylus* is the type.

Hagenius brevistylus Selys, Bull. Ac. Belg. 21 (2), p. 82, 1854; Hagen, Syn. Neur. N. Am., p. 114, 1861; Kirby, Synonymic Cat., 1890; Needham, Bull. 47, N. Y. State Mus., 440, 1901 (Bibliography).

Abd. male 55, female 60; h. w. male 48, female 52.

Male.—Black and yellow. Face yellow, vertex and occiput black. Thorax black; carina, a curved line on either side, narrow humerals, and two broad stripes on the sides, yellow. Abdomen black, a mid-dorsal yellow band on 1—8, sides of 8 and 9 yellow. Appendages shorter than 10. Wings faintly flavescent, costa yellow, pterostigma long, orange or yellowish.

Female.—Like the male. Occiput with hind border twice tubercled. The last segments of the abdomen are expanded laterally. Appendages as long as 10; vulvar lamina one-fourth as long as 9, black, and apex excavated.

Life Zone: Listed from many regions through four faunal areas, Boreal, Transition, Upper and Lower Austral, and also the Gulf strip of the Lower Austral.

"Upper Wisconsin River" (Hagen).

Time and Habitat—June to September over rapid streams.

OPHIOGOMPHUS Selys, Bull. Ac. Belg. 21 (2), p. 39, 1854.

A small group of brightly colored and closely related species. The main distinguishing characters are those based on the markings of the legs and the form of the male abdominal appendages. A single species is known from the state.

Ophiogomphus rupinsulensis Walsh, Proc. Ac. Phila., p. 388, 1862; Selys, Bull. Ac. Belg. 46 (2), p. 434, 1878; Needham, Bull. 47 N. Y. State Mus., p. 437, 1901 (Bibliography).

Abd. male 39, female 38; h. w. male 31, female 32.

Male.—Green and brown. Head green. Thorax with humerals wider above, ante-humerals and a spot on the sides indistinct brown or obsolete. Abdomen brown marked with yellow on dorsum. Segment 1—9 with basal elongated spots, pointed apically, 1 & 2 and 7—9 laterally, and most of 10 greenish yellow. Segments 7—9 somewhat expanded. Wings with costa yellow or green, pterostigma brown.

Female.—Similar. Markings diffused.

Life Zone: Transition and Upper Austral areas.

Wisconsin: "Upper Wisconsin River" (Hagen).

Time and Habitat—Moist woods and marshes from May to July.

GOMPHUS Leach, Edin. Encycl. 9, p. 137, 1815; Needham, Proc. U. S. Nat. Mus., 26, 715, 718, 721, 732, 1903 (Venation).

One of our most interesting and widely extended groups. The habits of the species are varied, certain ones frequenting the shores of some stable body of water, others preferring the rapid movement of rushing streams, or the sun-shine of fields and open places. They are often very hard to capture, being the most cautious and wary of dragon-flies.

The climatic conditions in Wisconsin ought to be very favorable to the Gomphines. Every variety of aquatic habitat is offered, beginning with swamps and creeks to large lakes and rivers.

But, due probably to collecting restricted to very few localities, not many species have thus far been found. From the Museum records I find that collection in localities which otherwise would certainly have been attended by success was belated in regard to Gomphines.

The compilation of a table for identification purposes presents certain difficulties, especially in finding a constant factor for distinguishing the different species. In the male the distinctive character is the form of the superior abdominal appendage, a quite constant feature. In the females the form of the occiput has been accepted as distinctive. But in several cases considerable variety was proven among representatives of the same species. The following dichotomy comprises mostly Gomphines found in the Boreal, Transition and Upper Austral life Zones:

1. Face entirely yellow..... 2
 Face transversely banded with black..... 22
 Face blackish..... 28
2. Occiput concave, convex, or notched..... 3
 Occiput with a median, prominent spine..... **villosipes**
3. Thoracic markings obsolete..... 4
 Thoracic markings distinct..... 5
4. Superior abdominal appendages shorter than inferiors... **lentulus**
 Superior abdominal appendages longer than inferiors... **pallidus**
5. Tibiæ yellow externally..... 6
 Tibiæ black externally..... 14
6. Abdominal segments 7—9 strongly dilated..... 7
 Abdominal segments 7—9 little dilated..... 8
7. Superior abdominal appendages of male with an outer truncate tooth; vulvar lamina short, broad, bifid..... **graslinellus**
 Superior abdominal appendages without an outer tooth, the lateral margins parallel; vulvar lamina long, bifid, contiguous, the apices separating, acute..... **externus**
8. Length of abdomen about 45 mm..... 11
 Length more than 45 mm..... 11
9. Segment 9 of abdomen yellow, length about 45 mm..... 10
 Segment 9 of abdomen brown, length about 41 mm..... **cavillaris**
10. Ground color yellow, length about 45 mm..... **intricatus**
 Ground color brown, length about 45 mm..... **exilis**
11. Colors olive and fuscous..... 12
 Colors yellow, or brown, and fuscous..... 13
 Colors yellow and black; male superior appendages with a long inferior basal tooth; vulvar lamina very short, the apex excised **minutus**
12. Male superior abdominal appendages with a sharp inferior tooth; vulvar lamina of two triangular lobes, one fourth the length of 9..... **spicatus**
 Male superior appendages with an inferior lobe; vulvar lamina of two rounded lobes, very short..... **sordidus**

13. Yellow and dark-brown; superior appendages trigonate, externally truncate; vulvar lamina very short, the apex excised **militaris**
Brown and fuscous; superior appendages trigonate; vulvar lamina oblong, bifid..... **pilipes**
14. Length between 40 and 50 mm..... 15
Length over 50 mm..... 16
Length under 40 mm..... **abbreviatus**
15. Abdominal segments 7—9 greatly dilated..... **ventricosus**
Abdominal segments 7—9 little dilated..... **quadricolor**
16. Dorsum of segment 9 yellow..... 17
Dorsum of segment 9 black..... 18
17. Segment 7—9 greatly dilated, vulvar lamina constricted at base **crassus**
Segment 7—9 little dilated, vulvar, lamina short, broad, bifid **olivaceus**
18. Segment 10 and appendages yellow..... 19
Segment 10 and appendages black..... 20
19. Segment 8 with a yellow basal spot, 10 with a yellow spot **cornutus**
Segment 8 black, 10 largely yellow..... **furcifer**
20. Segment 7—9 not expanded..... 21
Segment 7—9 greatly expanded..... **fraternus**
21. Superior abdominal appendages acute, outwardly truncated, the inferior tooth directed downward; vulvar lamina bifid **descriptus**
Superior abdominal appendages less acute, the inferior tooth directed far inward; vulvar lamina not so deeply bifid, less diverging **borealis**
22. Yellow stripes on thorax dilated anteriorly..... 23
Yellow stripes on thorax narrow, isolated..... **scudderi**
23. Sides of hind femora black..... 24
Sides of hind femora yellow..... **annicola**
24. One cell between veins A1 and A2 at their origin; length more than 45 mm..... 25
Two cells between veins A1 and A2 at their origin; length less than 45 mm..... **brevis**
25. Mid-lateral thoracic stripe incomplete; length above 50 mm.. 26
Mid-lateral thoracic stripe complete; length less than 50 mm. **adelpus**
26. Abdominal segments 8—9 with some yellow..... 27
Abdominal segments 8—9 black..... **dilatatus**
27. Dorsum of 8 with a basal spot yellow; 9 largely black.... **notatus**
Dorsum of 8 with a basal spot yellow; 9 largely yellow.... **vastus**
28. Ground color brown; segment 9 about equal to 8..... **plagiatus**
Ground color black; segment 9 much longer than 8..... **spiniceps**

The species of *Gomphus* can be naturally sub-divided into several groups or sub-genera. Chief distinctive characters are the presence of one or more cells between veins A1 and A2 of the anal angle, the sexual similarity or dissimilarity of the femora, the form of the posterior genital hamule of the male, and the

form—apically—of the eighth segment of the abdomen. Mr. Needham has accordingly grouped the species into four sub-genera, *Gomphus*, *Gomphurus*, *Stylurus* and *Arigomphus*. Grouping known species and such likely to be found within the state under these sub-generic names the result for Wisconsin is ten species of *Gomphus*, four of *Gomphurus*, one of *Stylurus*, and four of *Arigomphus*. For distinguishing the sub-genera the following table is appended:

- | | | |
|----|--|-------------------|
| 1. | Two cells between veins A1 and A2 at their origin..... | 2 |
| | One cell between veins A1 and A2 at their origin..... | 3 |
| 2. | Two cells; if one, elongated, the margin not thickened. | |
| | Hind femora of sexes similar; posterior genital hamule of male generally vertical; segment 8 square at apex..... | Gomphus |
| | Hind femora of sexes different, male hairy, female with many stout spines below; posterior genital hamule of male directed posteriorly; segment 8 oblique at apex..... | Arigomphus |
| 3. | One cell, the border thickened. | |
| | Abdominal segments 7—9 dilated; posterior genital hamule of male perpendicular..... | Gomphurus |
| | Abdominal segments 7—9 not dilated; posterior genital hamule of male directed anteriorly..... | Stylurus |
| | <i>Subgenus GOMPHUS.</i> | |

The characters of this group, as indicated by the table, are prominent enough to constitute a separate group of species. Several species, three in number, form a class by themselves by the presence of only one cell between veins A1 and A2 of the hind wing.

- | | | |
|----|--|----------------------------------|
| 1. | Two cells between veins A1 and A2..... | 2 |
| | One cell between veins A1 and A2..... | 6 |
| 2. | Segment 9 longer than, or at least equal to 8..... | 3 |
| | Segment 9 shorter than 8..... | brevis |
| 3. | Legs with some green or yellow..... | 4 |
| | Legs entirely black..... | quadricolor |
| 4. | Tibiae yellow externally..... | 5 |
| | Tibiae black externally..... | descriptus & borealis |
| 5. | Length about 52 mm..... | sordidus |
| | Length about 43 mm..... | exilis |
| 6. | Dorsum of 9 & 10 yellow..... | 7 |
| | Dorsum of 9 & 10 black..... | fraternus |
| 7. | Ground color black, markings olive and yellow..... | graslinellus |
| | Ground color dark brown, markings yellow..... | externus |

Gomphus brevis Hagen, Bull. Ac. Belg. (2) 46:464, 1878; Needham, Bull. 47 N. Y. State Mus., p. 449, 1901, (Bibliography, Description of nymph and imago).

Abd. male and female 31—33; h. w. 26—27.

Male.—Black and green. Face banded with black on all sutures, upper part of front and occiput olive. Thorax with a short mid-dorsal black line, not reaching the prothorax. The humeral and antehumeral stripes connected above. Legs entirely black. Abdomen black, yellow

as follows: a dorsal stripe on segments 1—2, a hastate spot covering the basal third of 3, a small basal triangular spot on 4—8, often obsolete. 9 and 10 are black. Sides of 1—3 largely yellow, margins of 7—9 slightly marked with yellow. These latter segments are somewhat expanded. Segment 10 is very short, hardly one-third the length of 9. Appendages widely separated, black. Wings hyaline, nervure black, costa black, the pterostigma brown.

Female.—Similar. Front femora green beneath. Segments 4—7 of abdomen with small basal lateral spots yellow.

Life Zone: Transition.

Wisconsin: Vilas Co., Divide, June 24-30, 1907.

Time and Habitat—May to July about lakes, ponds and creeks.

Gomphus quadricolor Walsh, Proc. Ent. Soc. Phila. 2, p. 248, 1863; Kirby, Synonymic Cat., 1890; Needham, Bull. 47 N. Y. State Mus., p. 452, 1903 (Bibliography).

Abd. male 32, female 33; h. w. male 26, female 27—28.

Male.—Olive and black. Dorsum of thorax with middle stripe short, widening in front, the humeral and antehumeral connected at both ends. Legs black. Abdomen black above, a stripe on 1—3, and small basal spots on 4—8 yellow. Sides greenish on 1—2, 8—9 yellow. Wings hyaline, costa yellowish, stigma brown.

Female.—Similar. Vulvar lamina short, emargine, the lobes rounded. A female in the Museum collection has the occiput of *vastus*, namely deeply excised, and its otherwise marked like *ventricosus*, segments 8—10 of the abdomen black on the dorsum. But from the latter it is readily distinguished by the presence of two cells between veins A1 and A2 at their origin, and likewise by the rounded lobes of the vulvar lamina, which are pointed in *ventricosus*. Also the sternum of 8 is produced in two lobes at the apex, so that the two pair of prominences appear superimposed.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., Milwaukee River, June 2, 1902.

Time and Habitat—May and June about rapid streams.

Gomphus sordidus Hagen, Bull. Ac. Belg. 21 (2), p. 244, 1854; Syn. Neur. N. Am., p. 106, 1861; Needham, Bull. 47 N. Y. State Mus., p. 454, 1901 (Bibliography & Desc. of nymph).

Abd. male 38, female 37; h. w. male 32, female 33.

Male.—Olive, brown and black. Face and occiput olive, the occiput margined with black. Thorax with a broad mid-dorsal stripe not reaching the prothorax, wider in front. Humeral and antehumeral connected at both ends, enclosing a narrow olive stripe. Legs black, the fore femora olive below, all the tibiae olive externally. Abdomen black, marked with olive. A mid-dorsal stripe on the basal segments, reduced to dashes on 4—9, 10 and the appendages usually yellow above or brown. Sides of 1—3 and 8—9 greenish yellow, basal spots on 3—7. Stigma of wings brown, costa olive. A specimen in the Museum collection has segment 10 of the abdomen and the appendages black, but the appendages have the same form as the typical *sordidus*.

Female. Similar. With more yellow on the abdomen and thorax. The vulvar lamina short, bifid. The female has great similarity to *spicatus* and *furcifer*. From the latter it is readily separated by its brown instead of black color, and also by the olive exterior surface of

the tibiae; in *furcifer* they are black. From *spicatus* it is distinguished by the vulvar lamina and the occiput. *Spicatus* has a spine on the occiput, the vulvar lamina are about one-third the length of segment 9, deeply bifid, the apices well separated and acute.

Life Zone: Boreal, Transition, Upper Austral.

Wisconsin: Divide, June 24-30, 1907.

Time and Habitat—May to July about lakes and streams.

Gomphus descriptus Banks and **borealis** Needham greatly resemble *sordidus*. They differ by the black dorsum of segments 9—10 of the abdomen and the black appendages. The female has a narrow yellow stripe on 10, the vulvar lamina are one-third the length of 9, the apical half bifid, acute and divaricate. The male *descriptus* has an acute inferior tooth on the superior abdominal appendage, while *sordidus* has an inferior lobe. In *borealis* the inferior tooth is directed far inward. Both species have black tibiae.

Gomphus exilis Selys, Bull. Ac. Belg. 21 (2), p. 55, 1854; Hagen, Syn. Neur. N. Am., p. 108, 1861; Needham, Bull. 47 N. Y. State Mus., p. 455, 1901 (Bibliography & Desc. of nymph); Needham & Hart, Bull. Ill. State Lab. 6, p. 82, 1901 (Desc. of nymph).

Abd. male 31—32, female 32—33; h. w. male 25—26, female 26—27.

Male.—Dark brown and greenish yellow. Face and occiput olive. Thorax with a mid-dorsal brown stripe, wider below, connected above with the antehumeral, separated by the green carina. Humeral and antehumeral and lateral sutures brown. Legs brown, the tibiae olive externally. Wings with costa olive, pterostigma brown. Abdomen darker, dorsum with a yellow stripe on 1—8. Sides yellow, most of 9 yellow.

Female.—Like the male. Abdomen with more yellow on the sides, and the dorsum of 9—10 yellow. Legs paler, the fore and middle femora green below, hind femora luteous except at the apex, all the tibiae green or yellow above, the feet black. Vulvar lamina one-fourth the length of 9, triangular, bifid, and apices rounded.

Life Zone: Transition and Upper Austral.

Wisconsin: Divide, June 24-30, 1907.

Time and Habitat—May to July about lakes and ponds.

Gomphus fraternus Say, Journ. Ac. Phila. 8, p. 16, 1839; Hagen, Syn. Neur. N. Am., p. 104, 1861; Calvert, Ent. News. 12, p. 71, 1901 (Differential Characters); Needham, Bull. 47 N. Y. State Mus., p. 451, 1901 (Bibliography & Desc. of nymph).

Abd. male 38, female 38—40; h. w. male 32, female 33.

Male.—Olive, yellow, dark brown, and black. Face and occiput olive, vertex black. Thorax olive, marked with dark brown. A mid-dorsal stripe not reaching the anterior edge of the thorax. A wide antehumeral and humeral connected at their lower edge, sometimes also above. Abdomen black, 1—7 with a mid-dorsal stripe, broad on 1—2, lanceolate on 3—7, interrupted at the apex of each segment, olive. The stripe ends with a triangular spot on the base of 8, rarely on 9. Sides yellow or yellowish green on 1—2 and 8—9, basal spots on 3—7. Appendages black. Segment 10 is about one-third the length of 9. Legs black, fore femora with some olive beneath. Costa of wings olive, pterostigma brown.

Female.—Similar. More yellow on the abdomen. The legs black,

the fore femora with olive below, the hind pair with an olive stripe on the outer surface. Vulvar lamina extending over two-fifths of 9, bifid, the apices diverging.

Life Zone: Upper Austral.

Wisconsin: Milwaukee County, June 1898, June 2-12, 1902, June 3-14, 1903.

Time and Habitat—May to July over rapid streams.

Gomphus externus Selys, Mon. Gomph., p. 411, 1857; Calvert, Ent. News, 12, p. 71, 1901 (Characters & Synonymy); Needham & Hart, Bull. Ill. State Lab., 6, p. 74, 1901.

Abd. male 37; h. w. male 31—32.

Male.—Dark brown and yellow. Occiput and face olive. Thorax yellow, a mid-dorsal brown stripe not reaching the anterior edge, divided by the carina. Humeral and antehumeral not connected, dark brown. Some brown on the lateral sutures. Legs black, all tibiae with a yellow or green stripe. Wings hyaline, the costa yellowish green, pterostigma brown. Abdomen with brown and yellow. A mid-dorsal yellow stripe on 1—3, reduced to basal dashes on 4—10. Sides of 1—3 and 7—9 yellow.

Female.—Similar. The hind margin of the occiput is very variable in shape, some specimens having it almost straight, others with several convexities and a median notch. Vulvar lamina contiguous for the basal two-thirds, tips acute, separating, the lateral margins parallel.

Life Zone: Upper Austral.

Wisconsin: Southeastern part of the State.

Time and Habitat—May to July over rapid streams.

Gomphus grasinellus Walsh, Proc. Ac. Phila., p. 394, 1862 (Description); Kellicott, Dragonflies of Ohio, p. 62, 1899 (Description); Williamson, Dragonflies of Indiana, p. 290, 1900 (Description); Needham & Hart, Bull. Ill. State Lab. 6, p. 69, 1901 (Nymph); Williamson, Ent. News, 14, p. 253, 1903 (Structural Characters & Description).

Abd. male 35, female 36; h. w. male 31, female 32.

Male.—Black, green and yellow. Face and occiput green, vertex black. Thorax green, with dark-brown markings. A mid-dorsal stripe wider at the anterior edge, humeral and antehumeral as wide as the mid-dorsal stripe, always connected at both ends, enclosing a fine green stripe, which is sometimes obsolete. Legs black, fore femora green beneath, all tibiae with an exterior green stripe. Costa green, pterostigma brown. Abdomen with a dorsal green stripe on all segments, becoming yellow on the apical segments. The stripe is broad on 1—2, twice constricted on 2, lanceolate on 3—7, interrupted at the apex of each segment, a basal triangular spot on 8, a broad streak on 9, fine and linear on 10. Sides with 1—3 and 8—10 yellow, basal spots on 1—7. Most of 10 and the appendages black.

Female.—Similar. More green and yellow on the abdomen. Segments with lateral streaks interrupted at the apex, Segment 10 largely yellow. Vulvar lamina short, broadly bifid.

Life Zone: Upper Austral.

Wisconsin: Milwaukee Co., Chicago road, July 26, 1902.

Time and Habitat—June to July in woods, and along streams.

A female taken with the male in Wisconsin has two cells between veins A1 and A2 at their origin, but otherwise it has the normal number of nine cells between the two veins.

Subgenus ARIGOMPHUS.

Like the preceding this group has two cells at the origin of veins A1 and A2. Distinctive characters are: the apex of abdominal segment 8 cut obliquely; the dissimilarity of the hind femora of the sexes, hairy in the male, spinose in the female; the posterior direction of the posterior male genital hamule. Four species belong to this subgenus.

1. Segment 10 and the abdominal appendages yellow..... 2
- Segment 10 and abdominal appendages black..... **spicatus**
2. Occiput even, segment 9 black..... 3
- Occiput with a prominent median spine, segment 9 yellow.... .
- **villosipes**
3. Male superior appendages seemingly bifurcate, segment 8 black, 10 largely yellow..... **furcifer**
- Male superior appendages bifurcate, segment 8 and 10 with yellow spot **cornutus**

Gomphus spicatus Hagen, Bull. Ac. Belg. 21 (2). p. 54, 1854; Syn. Neur. N. Am., p. 107, 1861; Needham, Bull. 47, N. Y. State Mus., p. 450, 1901 (Bibliography & Desc. of nymph); Needham & Hart, Bull. Ill. State Lab. 6, p. 77, 1901 (Description of nymph).

Abd. male 36—38, female 36; h. w. male 28—29, female 30.

Male.—Olive, brown and black. Face and occiput olive. Vertex black, hind margin paler. Thorax olive, marked with fuscous. A mid-dorsal stripe widened anteriorly. A humeral and antehumeral usually connected above. Lateral sutures marked. Legs black, fore femora green beneath, all tibiae with an exterior stripe of yellowish green. Costa yellowish green, pterostigma light brown. Abdomen with a dorsal band yellow or greenish; broad on 1—2, twice constricted on 2, lanceolate, pointed apically, the spots not reaching the apex of segments 3—7, a basal triangular spot on 8; 9 and 10 black. Yellow or greenish on sides of 1—2, basal on 3, sides of 8—9. Basal spots sometimes present on 3—7. Appendages normally brown, becoming black with age.

Female.—Similar. The Female differs by having the fore femora entirely olive, and the hind femora olive with the apex darkened. Vulvar lamina one fourth the length of nine, bifid, separating at the top. Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., May, 1900; Vilas Co., Divide, June 24-30, 1907; Door Co., Plum Island, July 6, 1905.

Time and Habitat—May to July about the shores of larger lakes and rapid streams.

A male *spicatus* from Door Co. has the inferior tooth of the superior appendage directed inward a trifle, so as to resemble *borealis* in a distant way. But from the latter it is easily separated by the vittate exterior surface of the tibiae.

Gomphus villosipes Selys is readily distinguished from all other Gomphines by the median spine on the hind margin of the occiput. The ground color is olive with dark brown markings. Thorax with mid-dorsal stripes short, narrow; humeral wide, antehumeral short. Legs black, fore femora green beneath, all the tibiae with a green stripe on the exterior surface. Costa of wings yellow, pterostigma light brown. Abdomen black, a dorsal stripe on 1—7, 8—9 brownish with green spots indistinct or obsolete, 10 and the appendages yellow. The

female has more yellow on the sides of the abdomen. Vulvar lamina short, bifid, the apices contiguous. The number of points on the occipital spine varies, sometimes as many as four points are present, other specimens have less, or the spine is simple. The range of this species covers two life zones, Transition and Upper Austral.

Gomphus furcifer Hagen. This species differs from the preceding mainly by the absence of the spine on the occiput. A minor difference is that the humeral and antehumeral stripes are often connected above. The appendages of the male are sufficiently distinct to separate it from villosipes. The vulvar lamina of the female are short, triangular, the apices separated (not contiguous) the lobes rounded. The life zone is similar to that of the preceding species.

Gomphus cornutus Tough, Occas. Mem. Chicago Ent. Soc. 1, p. 17, 1900 (Description & Figure).

Abd. male 40—42, h. w. male 32—33. (Female unknown).

Male.—Yellowish green, marked with black and brown. Face and occiput olive, the occiput margined with black, ciliated. Thorax olive. A mid-dorsal brown band on each side of the carina narrow, becoming obsolete at the anterior edge of the thorax. Humeral and antehumeral present. Legs black, fore femora olive beneath. Wings with costa olive, pterostigma light brown. Abdomen with a dorsal band of greenish yellow, the band reduced to lanceolate spots on the posterior segments, small and basal on 8. Dorsum of 9 black, 10 with a small spot, the appendages brown. The superiors are distinctly bifid, the external branch shorter, obtuse; the internal branch produced far inward, moving away from the exterior branch at an angle of more than 100°, slender, the apex acute.

Life Zone: Upper Austral and Transition. The designation of a limited life area for this species can be only tentative, since up to present year the species has been found in but two states, originally in Illinois.

Wisconsin: Dane Co., June 22, 1900 (Wm. S. Marshall).

Time and Habitat—June, about the shores of lakes.

Subgenus GOMPHURUS. The two following groups form a subdivision distinct from the preceding species. Both groups have in common the chief generic character, the presence of a single cell at the origin of veins A2 and A2, this cell with a thickened border, lending it such prominence as to form a distinct anal loop. Besides the anal loop the two groups resemble each other in the sexual similarity of the femora, and the square apex of the eighth abdominal segment. Points of difference for Gomphurus are: Abdominal segments 7—9 greatly dilated, the posterior genital hamule of the male perpendicular. Of the four species of this group none has as yet been found within the state, but from the fact that three have been taken in Iowa and Illinois and the fourth in the Upper Peninsula of Michigan we can conclude that they likewise inhabit the waters of Wisconsin.

1. Face banded with black..... 2
- Face entirely yellow..... **ventricosus**
2. Sides of hind femora black..... 3
- Sides of hind femora yellow..... **annicola**
3. Segments 3—10 of abdomen with basal rings and lateral spots;
 basal spots on dorsum of segments 8 & 9..... **scudderi**
- Segments 3—6 of abdomen with sides black, markings dorsal,
 no basal rings dorsum of 8 & 9 black..... **vastus**

Gomphus ventricosus Walsh. This species is very similar to *vastus* in color and markings. The chief specific difference is the entirely yellow or olive face. A minor distinction is that the black humeral and antehumeral are connected for some distance. The vulvar lamina of the female are bifid, the apices acute, more diverging than *vastus*. The life zone is the Upper Austral.

Gomphus amnicola Walsh. Colors yellow and black. Face with narrow black lines on the sutures, thorax black, marked with yellow: mesothoracic half-collar, two short oblique bars on the dorsum, a narrow, interrupted antehumeral, and nearly all of the sides, yellow. A broken line is found on the first lateral suture. Legs black, anterior femora beneath and hind femora with the exterior surface greenish yellow. Abdomen with a dorsal line on 1—2 yellow. A spot on 3 and 8, sides of 1—2 and 8—10 yellow. The vulvar lamina are contiguous at the apex. The species resembles *notatus*, from which it differs by its brighter color, the less complete thoracic markings, and the less divaricate male appendages. The vulvar lamina of *notatus* are short, the lobes separating, the apices rounded, conical. Life Zone: Upper Austral.

Gomphus scudderi Selys. Black, brown and greenish yellow. Face banded with black, thorax fuscous, marked with greenish yellow. Mid-thoracic and antehumeral stripes narrow. Abdomen black, segments 7—9 greatly dilated. Yellow basal rings on 3—10, the rings reduced on the posterior segments. Dorsum of 1 and 2 with a stripe of greenish yellow. 2 with a lateral spot. Faint yellow spots on sides of 4—6, prominent basal spots on 7—9. Dorsum of 8 and 9 with a small basal yellow spot. Segment 10, except for the linear basal ring, and the appendages black. Life Zone: Boreal.

Gomphus vastus Walsh. Face heavily banded with black. Thorax black, the markings greenish yellow. Dorsal stripes oblique, connected with the antehumeral above and the mesothoracic half-collar below, yellowish green. Abdomen black; segment 1—2 pale green; dorsum of 3—7 with an interrupted band of greenish yellow, ending in a triangular on the base of 7. Sides of 8 with a basal spot, and 9 largely bright yellow. Superior appendages black. Legs black, the anterior femora green beneath. The vulvar lamina of the female are more than half the length of 9, bifid at the apical third, the apices acute, the tips approaching each other.

Subgenus STYLURUS. In a disquisition on this subgenus Mr. Williamson has included five species in this group. Of these, however, Dr. Needham has diverted two, *amnicola* and *scudderi*, to the group *Gomphurus*, leaving *plagiatus*, *spiniceps*, and *notatus* to represent the group. *Stylurus* differs from *Gomphurus* mainly by the long, cylindrical (not dilated) abdomen, and the anterior direction of the posterior male genital hamule. The three species differ, as follows:

1. Abdomen black, marked with yellow or green..... 2
Abdomen yellowish brown, marked with yellow or green; segment 9 much shorter than 7.....**plagiatus**
2. Face with distinct black bands; segment 9 shorter than 7....**notatus**
Face suffused with black, no distinct markings; segment 7 and 9 about equal in length.....**spiniceps**

Either of these three species may be found within the state in the future, though as yet no specimen has been taken. But *G. plagiatus* can be expected with some assurance, since it is very common in Illinois.

Gomphus plagiatus Selys. Thorax brown, marked with yellow. Dorsal stripes divergent, two lateral stripes on each side of the thorax. Abdomen brown, segments 1—6 with an interrupted stripe of yellow or green. Life Zone: Upper Austral. Recorded also from the Gulf strip of the Lower Austral.

Because of its great similarity to the two species of this group the imagoes, especially the females, are easily confounded with each other. A short description of the sexual organs may serve to facilitate identification.

Male. Superior appendages widely divaricate, the lobes broad, sub-parallel, the apex with several minute inferior teeth, obliquely truncate to an external anteapical angle.....**plagiatus**

Female. Occiput straight, or slightly convex; vulvar lamina short, the apex emarginate, the tips acute.....**plagiatus**

Male. Superior appendages without well-marked anteapical angle**notatus**

Female. Occiput slightly concave; vulvar lamina exceedingly short, bifid, the branches divaricate, rounded.....**notatus**

Male. Superior appendages divaricate, the lateral external margins subparallel, the apex up-turned, with inferior minute teeth**sp:niceps**

Female. Occiput with a slight median notch; vulvar lamina short rounded**spiniceps**

DROMOGOMPHUS Selys, Bull. Ac. Belg. 21 (2), p. 58, 1854.

A genus intimately related to *Gomphus*, from which it differs mainly by the anal loop of two cells, and likewise by the fact that vein A1 is strongly angulated near its origin and forming one side of the loop, thus apparently arising from the outer angle of the anal loop. A prominent distinction are the extremely long hind femora, with armature of five to eight long strong spines. The species do not love the rushing streams and rapids of their nearest relatives, the Gomphines, but frequent the more quiet waters of creeks and ponds.

Hind femora entirely black.....**spinosus**

Hind femora yellow, the apex darkened.....**spoliatus**

Dromogomphus spinosus Selys, Bull. Ac. Belg. 21 (2), p. 59, 1854; Hagen, Syn. Neur. N. Am., p. 102, 1861; Needham, Bull. 47, N. Y. State Mus., p. 461, 1901 (Bibliography & Desc. of nymph).

Abd. male 41, female 43; h. w. male 34, female 36.

Male.—Black or brown, marked with olive. Face and occiput yellowish, vertex black. Thorax above olive, humerals brown and wide, equal to the width of the dorsal green area. On the dorsum the brown gives off a stripe below, which curves upward parallel to mid-dorsal carina, disappearing above. The brown humeral is divided by a sinuous green antehumeral. Legs black, fore femora green beneath. Wings hyaline, costa and nervure black, pterostigma dark brown. Abdomen black, yellowish beneath. Dorsum with a green stripe, twice

constricted on each segment, near the base and the apex, interrupted apically on the segment, ending on segment 8 and 9 as basal triangular spots. Sides of the segments largely yellowish green. Appendages black.

Female.—Similar. An acute black spine on the vertex behind each lateral ocellus. Occiput with a median notch, from which arises an acute spine. Dorsum of segment 10 green.

Life Zone: This is widely extended. The species has been taken in the Transition, Upper and Lower Austral, and also in the Gulf strip of the Lower Austral areas.

Wisconsin: Door Co., Horseshoe Bay, July 13, 1905.

Time and Habitat—June to July about shores of lakes and shaded rivers.

Dromogomphus spoliatus Hagen, Mon. Gomph., p. 409, 1857; Syn. Neur. N. Am., p. 103, 1861; Kellicott, Dragon-flies of Ohio, p. 72, 1899; Williamson, Dragon-flies of Indiana, p. 297, 1900.

Abd. male 45—46, female 47; h. w. male 37, female 38.

Male.—Yellow, or pale green, and brown. Face and occiput green, vertex dark brown. Thorax marked like spinosus. Legs yellowish, fore femora with a green stripe beneath. Wings hyaline, costa and nervure yellowish, pterostigma very pale yellow, nearly white. Abdomen dark brown, a stripe on the dorsum green, ending as a lanceolate basal spots on 8. Dorsum of 10 green. Sides of 1—2 yellowish, basal spots on 3—9. Appendages dark brown.

Female.—Similar. Abdomen with lighter brown and greenish on sides and dorsum. Occiput with an obtuse median prominence.

Life Zone: Transition, Upper Austral. This species seems less abundant than the preceding, since at present it is known from but three states, Texas, Ohio and Wisconsin.

Time and Habitat—June to July over fields and banks of lakes and streams.

Wisconsin: Door Co., Washington Island, July 7, 1907; Vilas Co., Divide, June 24-29, 1907.

There is some doubt as to the accuracy of the identification for a female from Washington Island. This specimen has the occiput with a median notch, from which arises a stout median spine. In this it resembles *spinosus*. Likewise it has a long acute spine behind each lateral ocellus on the vertex, but the spine is yellow instead of black. Also, the femora are largely yellow.

SUB-FAMILY AESCHNINAE.

The sub-family contains some of our largest and most voracious dragon-flies. In truth, of all the groups of Odonata they best merit the name of "dragon-flies", since in their nymphal stage there is hardly any animal they are able to capture upon which they do not prey. They are inclined to be cannibalistic, feeding upon their kind with great relish. The imagoes fly early and late in the season; that is, they are among the first to appear in the spring, and last to vanish in autumn. They frequent open places, mostly where some trees or bushes offer a ready hiding-place for

ambush. The species are widely distributed in all parts of the world. Genera found in the United States separate as follows:

1. Subnodal sector simple..... 2
 Subnodal sector furcate near the apical third..... 4
2. Triangle with several cross-veins, supra-triangular space veined. 3
 Triangle with one cross-vein, supra-triangular space free.....
3. Wings broad, basal space with cross-veins..... **Gomphaeschna**
 Wings narrow, basal space free..... **Boyeria**
4. Both sectors of the arculus arising not above its middle..... **Basiaeschna**
 Both sectors of the arculus arising above its middle..... **Anax**
5. One or two rows of cells between the subnodal and supplementary sectors..... 6
 Three or more rows of cells between the subnodal and supplementary sectors..... **Aeschna**
6. One row of cells between the subnodal and supplementary sectors **Nasiaeschna**
 Two rows of cells between the subnodal and supplementary sectors **Epiaschna**

GOMPHAESCHNA Selys, Trans. Ent. Soc. London, p. 413, 1871; Needham, Proc. U. S. Nat. Mus. 26, p. 718, 735, 737, 756, 762 (Venation).

This genus is represented by a single species found within the United States. Little is known of the habits, since it has rarely been captured. The present genus with the two following forms a separate group, the chief distinction of which is the simple subnodal sector, as shown by the table. As distinctive from its allies it might be well to mention several other features besides those furnished in the table. A prominent feature is the presence of but a single cross-vein under the stigma; also, the cubitus or the median space, as it is sometimes called, contains only two cross-veins, while the related genera boast of three or more. As a further distinction the wings are furnished but sparingly with cells, and these large, not fine and resembling the closely knitted net-like meshes of the other Aeschninæ. The single species, *G. furcillata* has been taken in the Upper Austral life Zone, but only in the more eastern states. The color of the species is brown, with the usual markings of the Aeschninæ.

BOYERIA MacLachlan, Ann. Mag. Nat. Hist. 17 (6), p. 424, 1896; Needham, Proc. U. S. Nat. Mus. 26, p. 735-737, 1903 (Venation).

Two species of this genus are known from the states. In common with its nearest ally, *Basiaeschna*, and distinctive from the preceding genus, *Boyeria* has several cross-veins under the pterostigma and three or more in the cubitus or median space. Both species of *Boyeria* occur in several life zones and are likely at any time to be discovered in the state.

Thorax with dorsal stripes narrow, each divided for some length;
 face suffused with brown.....**vinosa**
 Thorax with dorsal stripes wider, continuous; face clear green....

grafiana

Boyeria vinosa Say, Journ. Ac. Phila. 8, p. 13, 1839; Hagen, Syn. Neur. N. Am., p. 130, 1861; Needham, Bull. 47 N. Y. State Mus., p. 465, 1901 (Bibliography & Desc. of nymph).

Abd. male and female 50; h. w. male 42, female 44.

Male.—Dark brown, marked with green and yellow. Face greenish, suffused with brown. Thorax brown, dorsum each side with a green stripe, each divided for part of their length; laterally the thorax with two bright yellow spots. Wings hyaline, brown at base, the apices sometimes suffused with brown. Abdomen constricted at segment 3, each segment with transverse carina. Dorsum of segment 2 with a basal spot and an apical one, 3—5 with a small apical spot, 3—8 with an obscure at the transverse carina, 9 at the apical half, and 9 and 10 entirely. yellow. All the spots on segments 2—8 are divided to twin spots by the longitudinal mid-dorsal carina. Sides of 4—8 with a small yellow spot. Superior appendages dark brown, inferiors yellow.

Female.—Similar; the dorsal stripes on the thorax are obscured. The hind wings differ from those of the male by the rounded anal angle.

Life Zone: Boreal, Transition and Upper Austral.

Time and Habitat: June to September, along shaded streams.

Boyeria grafiana Williamson, Ent. News, 18, p. 1, 1907 (Description).

Abd. male 48—51, female 46—47; h. w. male 40—43, female 43.

The markings of this species, which was long mistaken for *vinosa*, are similar to those of the related species. But while the ground color of the latter species is brown with yellow and green markings, *grafiana* is black and gray with chiefly blue markings, the color contrasts are sharper, the markings more clearly defined. The wings have a smaller number of cells than *vinosa*, the pterostigma is about 5 mm. shorter.

Life Zone: Thus far collected in the Boreal and Upper Austral.

Time and Habitat—June to August along streams.

BASIAESCHNA Selys, Bull. Ac. Belg. 5 (3), p. 735, 1839; Needham, Proc. U. S. Nat. Mus. 26, p. 719 (Venation).

Basiaeschna janata Say, Journ. Ac. Phila. 8, p. 13, 1839; Hagen, Syn. Neur. N. Am., p. 125, 1861; Needham, Bull. 47 N. Y. State Mus., p. 466, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 762, 1903 (Venation).

Abd. male 40—43, female 43; h. w. male 37—38, female 39.

Male.—Brown, marked with green and yellow. Face greenish, reddish in faded specimens, frons with a black T spot above. Thorax with a dorsal stripe green on each side of the carina, the stripes diverging at the anterior edge. Sides each with two yellow or white stripes margined with black. Legs brown. Wings hyaline, spotted at the base with dark brown, the nervure dark brown, costa and pterostigma yellow; the postnodal cells, especially those nearer to the stigma, are tinged with yellow. Abdomen marked with green rings and spots, the

segments becoming reddish brown with age. Appendages dark brown, the superiors as long as segment 9 and 10, the inferiors half as long.

Female.—Differs from the male by the straight appendages and the rounded anal angle of the hind wings. Both sexes have the membrane of all the wings white.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., Milwaukee River, Spring 1899.

Time and Habitat—April to June along streams and ponds.

NASIÆSCHNA Selys. Foerster, *Odonaton aus Neu-Guinea*, 1900; Needham, *Proc. U. S. Nat. Mus.* 26, p. 718, 736, 755, 762, 1903 (Venation).

The present genus heads the second group of *Aeschninæ*, distinguished by the furcate subnodal sector. In common with two other genera, *Epiæschna* and *Aeschna*, it separates from the fourth genus, *Anax*, by the position of the sectors of the arculus at their origin, as indicated by the table. Distinguishing it from its allies, it is furnished with but a single row of cells between the subnodal and supplementary sectors. As a further distinction it might be mentioned that the principal and nodal sectors are sub-parallel opposite the stigma. The single species, *penthacantha*, was formerly placed in *Aeschna*, but in a paper for the year 1901 Dr. Needham gave it its proper position under *Nasiæschna*. The imago resemble *Aeschna constricta*, from which it is readily distinguished by the absence of a black spot on the frons above, and the venation. Although the species has been taken in Illinois, it is not likely to be found in Wisconsin. It appears to be regional in the Austral Life Zone.

EPIÆSCHNA Slys, *Proc. Bost. Nat. Hist. Soc.* 18, p. 36, 1875; Needham, *Proc. U. S. Nat. Mus.* 26, p. 718, 736, 755, 762, 1903 (Venation).

Besides the difference indicated in the table, *Epiæschna* is distinguished from *Nasiæschna* by the fact that the nodal sector approaches the principal sector opposite the stigma. One species is recorded from the United States.

Epiæschna heros Fabricius, *Ent. Syst. Suppl.*, p. 185, 1798; Hagen, *Syn. Neur. N. Am.*, p. 128, 1861; Needham, *Bull. 47 N. Y. State Mus.*, p. 469, 1901 (Bibliography & Desc. of nymph).

Abd. male 62—66; female 67; h. w. male 54—56; female 59.

Male.—Brown, with green markings. Face brown and green, eyes blue. Thorax with two dorsal stripes of green, widened above to an inward angle. Sides each with two broad stripes of green. Legs black, the femora brown, darkened apically. Wings hyaline, the median area below the nodus tinged with yellow, nervure black, costa and stigma light brown. Abdomen brown, each segment crossed by a transverse carina at the basal third, marked with green transverse stripes or spots at the base, the apex and before the transverse carina. All stripes divided by the dorsal longitudinal carina. Sides with spot at the carina green. Superior appendages black, trigonal, as long as 9 and 10. Segment 10 with a middle acute prominence marking the end of the mid-dorsal carina.

Female.—Segment 10 with a triangular prominence beneath, denticulate at the apex. Vulvar lamina enclosed; longer than 9, curved, the apex bifid, acute, the points diverging and reaching into a groove in the prominence on the sternum of segment 10.

Life Zone: Common throughout the Transition and Austral areas.

Wisconsin: Milwaukee Co., Spring 1899, July 1900, June 8, 1906.

Time and Habitat—May to September, in woods and open places.

ÆSCHNA Fabricius, Syst. Ent., p. 424, 1775; Needham, Proc. U. S. Nat. Mus. 26, p. 732, 734-737, 1903 (Venation).

A genus of wide distribution, numbering above 50 species. Three species have been found within the state and it is possible that one or two others will be found. The species separate as follows:

1. Males.—Hind wings with the anal angle acute, containing an anal triangle..... 2
Females.—Hind wings with anal angle rounded; no anal triangle 4
2. Anal triangle of two cells; three dorsal transverse spines on 10. 3
Anal triangle of three cells; no dorsal spines on 10; appendages with an inferior apical spine.....*constricta*
3. Superior longitudinal carina of the superior appendages even..
verticalis
Superior longitudinal carina of the superior appendages denticulated*clepsydra*
4. Genital valve strongly elevated at apex; vulvar lamina about 2 mm.; width of appendages 2—2½ mm.....*constricta*
Genital valves not strongly elevated at apex; vulvar lamina about 1 mm.; width of appendages 1—1½ mm.....*verticalis*

Æschna constricta Say, Journ. Ac. Phila. 8, p. 11, 1839; Hagen, Syn. Neur. N. Am., p. 123, 1861.

Abd. male 55—59, female 53—54; h. w. male 46—49, female 44—47.

Male.—Brown, marked with bright and blue. Face green, rarely brown, frons with a black T spot above. Occiput white centrally. Thorax with two dorsal stripes green, each side with two greenish stripes, widest above. Legs dark brown. Wings hyaline, the nervure dark, costa light brown, stigma brown. Abdomen with apical spots on the dorsum and basal spots on the sides green and blue. Segment 10 above green or blue, appendages light brown.

Female.—The female has less blue than the male on the abdomen. The wings are often tinged with yellowish, the appendages are longer and leaf shaped.

Life Zone: Widely distributed through the Boreal, Transition and Upper Austral areas.

Wisconsin: Milwaukee Co., July 10, 12, Aug. 24, Sept. 6, 1902; July 27, 1903; Sept. 5, 1904; Dane Co., July 1900.

Time and Habitat—June to October along shores of lakes and streams.

Æschna verticalis Hagen, Syn. Neur. N. Am., p. 122, 1861.

Abd. male 52, female 53—54; h. w. male 45—46, female 46—48.

Male.—Color reddish brown, marked much like *constricta*. Abdomen not so thick. The female has the sternum of segment 10 cov-

ered with numerous minute slender black spines, about twice the length of those found on *constricta*. Those of the latter are broad, triangular in shape, not so acute and about half as long.

Life Zone: Transition, Upper Austral.

Wisconsin: Milwaukee Co.: Aug. 24, 1902; June 26, July 1, 20, 26, Sept. 26, 1903; Aug. 8, 1905; Portage Co., Aug. 26, 1905; Milwaukee Co., Aug. 1, 1907.

Time and Habitat—June to October in woods, along streams.

Aeschna clepsydra Say, Journ. Ac. Phila. 8, p. 12, 1839; Calvert, Ent. News, 5, 13, 1894 (Bibliography & Synonymy); Kellicott, Dragonflies of Ohio, p. 84, 1899; Williamson, Dragonflies of Indiana, p. 304, 1900.

Abd. male 52—55, female 52; h. w. male 45—50, female 44.

Male.—Markings and coloration similar to *verticalis*. Differs by the denticulated superior carina of the superior abdominal appendages. The female is said to be indistinguishable.

Life Zone: Boreal and Transition. Also found in some spots of the Upper Austral area.

Wisconsin: Nagowicka Lake, Aug. 20, 1901; Milwaukee Co., June 8, 1906.

Time and Habitat—June to September in woods and about lakes.

ANAX Leach, Edinb. Encycl. 9, p. 137, 1815; Needham, Proc. U. S. Nat. Mus. 26, p. 714 ff., 1903 (Venation).

A genus distinct from all other Aeschnæid genera by the position of the sectors of the arculus above the middle of the arculus at their origin. Two species are found in the Transition and Austral zones. *A. junius* and *A. longpipes*. They are readily separated by the presence of a spot on the frons above in *junius*, absent in *longpipes*.

Anax junius Drury, Ill. Exot. Ent. 1, p. 112, 1770; Needham, Bull. 47, N. Y. State Mus., p. 470, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 710 ff., 1903 (Venation).

Abd. male 53—55, female 54; h. w. 49—51, female 49—52.

Male.—Bright green, marked with brown and blue. Face green, frons above with a black or brown spot surrounded by an olive and a blue ring. Thorax bright green, legs black, all the femora light brown. Wings hyaline, nervure black, costa and pterostigma yellow, the wings tinged with yellow about the base and the nodus and the middle area. Abdomen with segment 1 and base of 2 green, or 2 entirely green, the other segments blue with a dorsal longitudinal stripe brown. Segment 1 and 2 are greatly dilated, 3 constricted.

Female.—Like the male. The second segment of the abdomen entirely green, less often with blue at the apex. Abdomen darker, less constricted at segment 3. The occiput deeply emarginate. Wings with more yellow.

Life Zone: Common everywhere in North America.

Wisconsin: Dane Co., June 1900; Milwaukee Co., Aug. 26, 1899; July 1900; Apr. 21, Aug. 8, 23, Sept. 10, 1902; Apr. 30, July 27, Aug. 26, 1903; Aug. 26, 1904; Aug. 24, 1907.

Time and Habitat—March to November under all conditions. A cosmopolite.

FAMILY LIBELLULIDÆ.

SUB-FAMILY MACROMIINÆ.

Introducing the third family of dragon-flies, the Macromiinae are unique among Odonates by having the triangle of the hind wings placed far beyond the level of the arculus. In this peculiarity the nymphs also take part, possessing a horn, pyramidal in shape, on the front of the head. Together with the *Cordulinæ* the imagoes of the *Macromiinae* have a tubercle on the eyes behind. The males further resemble the *Cordulinæ* by the auricles on the sides of segment 2 of the abdomen and by the excavated anal margin of the hind wings. The *Macromiinae* are composed for the greater part of large species that expand from 80 to 110 mm. They fly in the vicinity of their aquatic homes and are rarely captured far from it. Their wings are strong, their flight is regular and well sustained. The two genera of the group separate, as follows:

Eyes barely touching; occiput larger than vertex; four to six cross-veins in the space above the bridge.....**Didymops**
 Eyes touching for some distance; occiput smaller than vertex; two to four cross-veins in the space above the bridge.....**Macromia**
DIDYMOPS Rambur, Ins. Nev., p. 142, 1842; Needham, Proc. U. S. Nat. Mus. 26, p. 756, 1903 (Venation).

The genus is represented by a single species confined to North America. At present it is not known to have been collected in Wisconsin, but from its occurrence in many parts of the Transition and Upper Austral life zones it may be inferred that the species is native also in Wisconsin.

Didymops transversa Say, Journ. Ac. Phila., 8, p. 19, 1839; Hagen, Syn. Neur. N. Am., p. 135, 1861; Needham, Bull. 47, N. Y. State Mus., p. 481, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 711, 763, 1903 (Venation).

Abd. male 37, female 39—40; h. w. male 33—35, female 37—38.

Male.—Color brown marked with pale yellow. Face brown with a transverse greenish stripe. Frons with a black spot above. Thorax brown, a narrow antehumeral and sides each with a large broad stripe yellowish or white. Legs brown, feet black, tibiae yellowish above. Wings hyaline, brownish at base, nervure brown, costa yellow, pterostigma brown. Abdomen brown, segments 7—9 laterally expanded, the segments marked more or less with rings, 7 with a white ring at the base prominent, laterally a spot at the base of 8, 10 entirely yellowish. Appendages yellow, longer than 10.

Female.—Larger than the male. Wings with more brown at the base. The abdomen uniform, not expanded.

Life Zone: Transition, Upper and Lower Austral.

Time and Habitat—May to August about lakes.

MACROMIA Rambur, Ins. Nev. U. S. Nat. Mus. 26, p. 740, 1903 (Venation).

Six or seven species are known from the United States, four have been found in the Upper Austral life zone. The species are recognized by their large size, 85-100 and more mm. and by the bright yellow transverse markings of the abdomen.

1. Antehumeral stripe present..... 2
Antehumeral stripe absent; frons steel blue above..... *illinoensis*
2. Antehumeral stripe complete..... 3
Antehumeral stripe short; expanse above 110 mm..... *tæniolata*
3. Length of abdomen less than 50 mm..... *pacifica*
Length of abdomen more than 50 mm..... *annulata*

Macromia illinoensis Walsh, Proc. Sci. Phila., p. 397, 1862; Needham, Bull. 47, N. Y. State Mus., p. 483, 1901 (Bibliography).

Abd. male 48—50, female 50; h. w. male 44, female 46.

Male.—Colors brown black, metallic green, markings bright yellow. Face brown, labrum yellow, a transverse band below the frons yellow; frons blackish, changing to steel blue above; vertex and occiput black. Thorax metallic green, the crest above with a narrow yellow line; sides each with a long yellow stripe. Legs black, hind tibiae below with a fine yellow stripe. Wings hyaline, nervure black, the base slightly tinged with fuscous, costa paler, pterostigma black. Abdomen black, a yellow spot each side of the mid-dorsum on 2—5, undivided and basal on 7, very slight on base of 8. Sides of 2 with diffused yellow. Segments 7—9 expanded, the expansion with a basal spot. Appendages black, lyre-shaped.

Female.—Similar. More yellow on the abdomen, wings with more fuscous at base.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Cement Mills, July 25, 1903.

Time and Habitat—June to August along streams. Congregate in moist woods, resting on the underside of twigs. (Osborn.)

Macromia tæniolata Rambur, Ins. Nev., p. 139, 1842; Hagen, Syn. Neur. N. Am., p. 132, 1861; Needham, Bull. 47, N. Y. State Mus., p. 484, 1901 (Bibliography).

Abd. male 58—60, female 61—62; h. w. male 52—54, female 58.

Male.—Colors like the preceding species. Thorax with a short antehumeral stripe below and a lateral band yellow. Legs black. Wings more or less tinged with yellow. Abdomen black, a transverse ring on 2, divided spots on 2—8, entire on 7, yellow.

Female.—Wings with more yellow. The spot on dorsum of segment 8 usually lacking.

Life Zone: Upper and Lower Austral.

Time and Habitat—Late May to July along streams and in damp woods.

Macromia pacifica Hagen, Syn. Neur. N. Am., p. 134, 1861; Williamson, Dragon-flies of Indiana, p. 309, 1900.

Abd. male 47, female 48; h. w. male 40, female 45.

Male.—Steel blue, black, fuscous, marked with bright yellow. Face fuscous, a yellow transverse band below the frons; frons brown, yellow above. Thorax metallic blue, the antehumeral stripes yellow, not quite reaching the yellow transverse stripe on the crest above. A lateral band between the wings encircling the entire thorax. Legs brown, the

feet black. Wings hyaline, yellow at the base, costa and pterostigma yellow. Abdomen black, segment 2 circled basally by a broad yellow band, divided on the dorsum. Segment 3—7 with dorsal divided spots, entire on 7 and 8.

Female.—Similar, larger, the wings sometimes yellow, more so at the base.

Life Zone: Upper and Lower Austral. The species has been found in but four States, Texas, California, Illinois and Wisconsin.

Wisconsin: Milwaukee, Cement Mills, July 2, 1902.

Time and Habitat—June, July, along streams.

SUBFAMILY CORDULINAE.

The present sub-family forms the connecting link between the two other sub-families of the most interesting group of dragonflies, the Libellulidæ. In common with the preceding sub-family this group has tubercled eyes, the males also with auricles on the sides of the second abdominal segment and excavated anal margins of the hind wings. To the Libellulinæ the group is related by the position of the triangle of the hind wings even with or before the level of the arculus. In habits they are related to the *Macromiine*, preferring the vicinity of their aquatic homes to the sunshine of fields and roadsides. The genera can be separated by the following table:

- | | |
|---|----------------------|
| 1. Fore wing with the short sector and the upper sector of the triangle approximated apically..... | 2 |
| Fore wing with the short sector and the upper sector of the triangle parallel or divergent apically; all wings with dark spots at the base, the nodus and the apex..... | Neurocordulia |
| 2. Internal triangle present in the hind wing..... | 3 |
| Internal triangle absent in the hind wing..... | 5 |
| 3. Stigma normal, triangle of hind wings crossed..... | 4 |
| Stigma diamond-shaped, triangle of hind wings free.... | Helocordulia |
| 4. Wing clear, (triangles of hind wings rarely free).... | Somatochlora |
| Wings with dark markings at base, nodus and apex.... | Epicordulia |
| 5. Triangles of fore wings crossed..... | 6 |
| Triangles of fore wings free..... | Dorocordulia |
| 6. Wings with basal markings, hind wings with four antenodals..... | Tetragoneuria |
| Wings clear, more than four antenodals, male inferior abdominal appendages bifurcate..... | Cordulia |

NEUROCORDULIA Selys, Bull. Ac. Belg. 31 (2), p. 278, 1871.

Several species of this genus have been found in the Transition and Austra life areas, but it is hardly likely that more than one, *obsoleta*, is to be found within the state. *N. obsoleta* is known from Illinois and other places in the Austral regions. It is recognized from its dull brown color and obscure markings, which consist mainly in a short transverse line on each side of the dorsal

carina near the front edge, and a lateral spot of yellow. The appendages of the male are thickened at the apical half and without an inferior angle.

HELOCORDULIA Needham, Bull. 47, N. Y. State Mus., p. 495, 1901.

In the paper referred to Dr. Needham has discussed the characters upon which he based the separation of *Helocordulia* from the preceding genus, *Neurocordulia*. Besides the characters mentioned in the table, Dr. Needham has noted several others when comparing *Helocordulia* to its prototype, *Neurocordulia* and to its nearest ally, *Tetragoneuria*. Such differences are:

a. **HELOCORDULIA**—Hind wings with six antenodals and free triangles, fore wings with a single cross-vein in the triangle.

NEUROCORDULIA—Hind wings with five antenodals and triangles crossed once, twice crossed in the fore wings.

b. **HELOCORDULIA**—Sub-triangle present, two cross-veins under the stigma, six antenodals in the hind wings.

TETRAGONEURIA—Sub-triangle absent in hind wings, a single cross-vein under the stigma, four antenodals in the hind wings.

The two species may be separated by their genitalia:

Male superior abdominal appendages with a distinct inferior tooth before the middle, the apex thickened, hairy; female vulvar lamina nearly one-half the length of 9, deeply bifid, divaricated **selysii**

Male superior abdominal appendages without a distinct inferior tooth, the apex thickened, naked; female vulvar lamina less than one-third the length of 9, emarginate, the points widely divaricated, the lateral margins sub-parallel..... **uhleri**

Of these two species *Uhleri* alone has been taken as far west as Ontario, and there is some possibility of finding it in the middle portions of the State.

SOMATOCHLORA Selys, Bull. Ac. Belg. 31 (2), p. 279, 1871; Needham, Proc. U. S. Nat. Mus. 26, p. 741, 1903 (Venation).

About 40 species of this genus are known. Our American species inhabit chiefly the colder life areas, few species as yet being taken in regions warmer than the Upper Austral. For Wisconsin we have only a single record of a species by Hagen. But the remarkable similarity of the fauna of northern Wisconsin to that of the White Mts. of New Hampshire leads us to expect the presence of a similar number of species in the mountainous portions of our state. The different species are greatly alike in color and pattern of the markings. They are separated chiefly by the form of the superior abdominal appendages of the male. Accepting the superior appendages as criterion, the five New Hampshire species have the following points of difference:

tenebrosa—apical half abruptly incurved, directed downward, a superior tooth at the deflection; inferiors recurved, furcate.

cingulata—differing from the preceding by the superiors, inferiors similar.

albicincta—a basal tooth, an inferior median tooth.

walshii—an external obtuse prominence at the basal third.

elongata—apices upturned, an inferior basal tooth.

Somatochlora elongata Scudder, Proc. Bost. Noc. Nat. Hist. 10, p. 218, 186; Hagen, Proc. Bost. Soc. Nat. Hist. 18, p. 58, 1875 (Bibliography); Needham, Bull. 47 N. Y. State Mus. 499, 1901 (Description of nymph).

Abd. male and female 42—45; h. w. 36—38.

Male.—Metallic green and brown, marked with obscure yellow. Lower part of face brownish, frons and vertex dull green. Thorax metallic green, an obscure brown spot on each side of the dorsum near the anterior edge. Legs black, fore femore brownish above. Wings hyaline, stigma black. Abdomen blackish green, dilated at base, sharply constricted at 3, then gradually widening to 6, equal in width to the first segments. Segment 2 with a spot on either side of dorsum and sides, 3 with a basal spot, luteous or obscure yellow. Appendages black.

Female.—Similar. Abdominal segments 1 and 2 and base of 3 brownish. Wings sometimes with a smoky tinge about the nervures. Vulvar lamina as long as 9, forming a triangular trough at right angles to the sternum of 9.

Life Zone: Transition.

Wisconsin: "Upper Wisconsin River" (Hagen).

Time and Habitat—July to September along streams and about lakes.

EPICORDULIA Selys, Bull. Ac. Belg. 30 (2), p. 259, 1871.

The single species of this genus is easily recognized by its large size and the spots at the base, the nodus, and the apex of all the wings. In the markings of the wings it resembles certain Libellulinae, such as *Libellula pulchella*, differing, however, from that species by the longer body and other characters referred to in the table. The imagoes, restive in flight, prowl about slow or standing waters.

Epicordulia princeps Hagen, Syn. Neur. N. Am., p. 134, 1861; Needham, Bull. 47 N. Y. State Mus., p. 488, 1901 (Bibliography & Desc. of nymph).

Abd. male 44, female 46; h. w. male 41, female 44.

Male.—Colors olive or brownish yellow, marked with yellow. Face olive. Thorax with gray or brownish hair. Sides with an obscure yellow stripe margined on the anterior side with fuscous. Legs black, the femora brown. Wings hyaline, nervure black, costa and stigma black, brown spots at the base, the nodus and apices of all wings, the spots larger on the hind wings. Abdomen dark brown, most of segment 1 and 2 and sides of 1—8 with yellow, segment 9 and appendages black. The superior appendages with two obtuse internal prominences, at the basal and the apical third.

Female.—Similar. vulvar lamina bifid, forcipate, nearly as long as the sternum of 9.

Life Zone: Transition and Upper Austral.

The species has been taken so near the boundary line of Illinois and Wisconsin, that it certainly can be expected in the State.

Time and Habitat—May to July about ponds and quiet waters.

DOROCORDULIA Needham, Bull. 47 N. Y. State Mus., p. 504, 1901 (Discussion of Characters).

The species of the present genus were separated from *Cordulia* chiefly because of differences in venation, such as open triangles and the presence of only two complete rows of cells beyond the triangles in the fore wings. Another point of difference is the entire (not furcate) inferior appendages of the male. The imagoes are small, with metallic colors, graceful in flight, though less rapid than the preceding species, but quite as restive. Three species are known:

1. Apex of abdomen (7—9) gradually and moderately dilated.... 2
Apex of abdomen (7—9) suddenly and spatulately dilated..*libera*
 2. Joints of abdomen yellowish.....*lepida*
Joints of abdomen without yellow.....*lintneri*
- Dorocordulia libera** Selys, Bull. Ac. Belg. 31 (2), p. 263, 1871; Needham, Bull. 47, N. Y. State Mus., p. 504, 1901 (Description of nymph); Williamson, Dragon-flies of Indiana, p. 314, 1900 (Description of imago).

Abd. male 31, female 29; h. w. male 30, female 31.

Male.—Color metallic green, obscured on the thorax by brown hair. Mouth yellow, face green. Abdomen green, sides of 1—2 black with brownish spots, the posterior segments black. Legs black. Wings hyaline, nervure, costa and stigma black. The base of the wings marked sparingly with brown or yellow.

The female is similar.

Life Zone: Transition.

Wisconsin: Dane Co., June 1890; Door Co., Plum Island, July 6, 1905.

Time and Habitat—June and July about small lakes.

CORDULIA Leach, Edin. Encycl. 9, 1815.

The single species of this genus, *C. shurteffi* Scudder, is readily distinguished from its allies by the points specified in the table. In color and the few markings it resembles the preceding species *D. libera*, differing however, by having the abdomen more equal, not widely expanded at the apical segment. The species may be expected in Wisconsin, since it is found in Transitional regions.

TETRAGONEURIA Hagen, Syn. Neur. N. Am., p. 140, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 723-726, 1903.

Four species are referred to this genus.

1. Frons without a black T-spot above; if so, only faintly evident;
triangle of hind wing generally crossed..... 2
Frons with a black T-spot above distinct; triangle of hind wing
generally free.....*spinigera*
2. Hind wings with four antenodals..... 3
Hind wings with five antenodals.....*spinosa*

3. Hind wings with fuscous streaks restricted to space within the level of the first antenodal.....**cynosura**
 Hind wings with the fuscous more distributed, not in isolated streaks, reaching beyond the level of the first, and generally to the fourth antenodal.....**semiaquea**

Taking the triangle of the hind wing, whether crossed or free, as a specific character, it is well to mention that this by no means is a constant factor for determination. In the collections of the Public Museum I have seen specimens of *cynosura* with the triangle free, and of *spinigera* with the triangle crossed.

Tetragoneuria spinigera Selys, Bull. Ac. Belg. 31 (2), p. 269, 1871; Needham, Bull. 47, N. Y. State Mus., p. 493, 1901 (Bibliography).

Abd. male 30—33, female 32; h. w. male 29—33, female 32—33.

Male.—Brown, marked with black and yellow. Face yellow, a greenish transverse band below the frons. Frons above with a prominent black T-spot. Thorax brown, dorsal stripes, meral and lateral sutures black. Generally these markings are hidden below the thick gray pile. Legs black, fore femora brown. Wings hyaline, nervure black, costa and stigma brown. Fore wings with the extreme base fuscous, hind wings with streaks along the median vein and the anal angle. Abdomen with segments 1, 2 and the base of 3 brown. Segment 2 is dilated, 3 slightly constricted, 4—9 flattened. Dorsum black, wider apically, lateral yellow spots on 2—9. Appendages black, the superiors with an inferior spine at the basal third.

The female is similar.

Life Zone: Transition and Upper Astral.

Wisconsin: Milwaukee County, June 1900; Dane County, May 1900; Vilas Co., Divide, June 24-30, 1907.

Time and Habitat—June to July about lakes and in forest clearings.

Tetragoneuria cynosura Say, Journ. Ac. Phila. 8, p. 30, 1839; Hagen, Syn. Neur. N. Am., p. 139, 1861; Needham, Bull. 47 N. Y. State Mus., p. 494, 1901 (Bibliography).

Abd. male 28—39, female 27; h. w. male 28, female 29.

Male.—Differs from the preceding species mainly by the absence of a T-spot on the frons and by its smaller size. The abdominal appendages are curved, touching at the middle the apices thickened.

The female is similar, the vulvar lamina exceeding the sternum of 9 in length, bifid.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June 4, 1899.

Time and Habitat—May to July about smaller waters (ponds and creeks).

Tetragoneuria semiaquea Burmeister, Handbuch der Entomologie, 2 p., 858, 1839; Hagen, Syn. Neur. N. Am., p. 140, 1861; Needham, Bull. 47 N. Y. State Mus., p. 494, 1901 (Bibliography).

Abd. male 26—27, female 28; h. w. male 26—28, female 29.

Male and female.—This species resembles *cynosura* greatly. The chief distinction is that the fuscous of the hind wings is more suffused, always extending at least beyond the second antecubital.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., June 2, 1900.

Time and Habitat—May to July about smaller waters.

SUB-FAMILY LIBELLULINAE.

This sub-family includes by far the largest number of dragon-flies of any sub-family. The species, wherever found, are abundant, and are easily recognizable by the proportionately large wings and their short, stout, often flat bodies. They are familiar objects along the road-sides, often flying far from their aquatic homes. The thirteen North American genera separate as follows:

1. Hind wings narrow at the base; triangle of fore wing level with the apex of the triangle of the hind wing..... 2
- Hind wings very wide at the base; triangle of fore wing far beyond the level of the apex of hind triangle..... 12
2. Triangle of fore wing normal (three sides)..... 3
- Triangle of fore wing with four sides..... **Nannothemis**
3. Subtriangle of fore wing crossed; sides of triangle meeting at right angles (90°); hamules of male bifid..... 4
- Subtriangle of fore wing free; sides of triangle meeting at an obtuse angle (100°); hamules of male not bifid.... **Perithemis**
4. Hind lobe of prothorax large, bilobed..... 5
- Hind lobe of prothorax small, entire..... 9
5. Sectors of the arculus pedicellate..... 6
- Sectors of the arculus contiguous or separate at their origin; wings generally with yellow or brown markings.... **Celithemis**
6. Hind wings with the upper sector of the triangle departing from the hind angle..... 7
- Hind wing with the upper sector of the triangle departing above the hind angle on the outer side..... 8
7. Length of stigma more than three times the width; face yellowish **Sympetrum**
- Length of stigma hardly twice the width; face pure white.... **Leucorhinia**
8. One cross-vein under the stigma, a large vacant space before it; hind tibiae with two rows of about 10 small spines..... **Pachydiplax**
- Two cross-veins below the stigma, spaces before it normal; hind tibiae with a row of 5—7 stout spines..... **Mesothemis**
9. Sectors of the arculus contiguous at their origin; hind wing with upper sector of the triangle arising from the hind angle 10
- Sectors of the arculus stalked; hind wing with the upper sector of the triangle arising above the hind angle.... **Micrathyria**
10. Triangle of fore wing with two parallel cross-veins; sub-triangle of 4—11 cells..... 11
- Triangle of forewing with a single-cross-vein; sub-triangle of three cells..... **Ladona**
11. Male without ventral hooks on segment 1 of abdomen; female tibiae longer than hind femora; sexes with similar wing-markings* **Libellula**
- Male with ventral hooks on segment 1 of abdomen; female

* The male of *L. pulchella* has ventral hooks on segment 1, but this species is placed with *Libellula* because of the other distinctions cited for the genus.

- with hind tibiae and femora equal in length; sexes with dissimilarly colored wings*.....**Plathemis**
 12. Hind wings with a broad basal fuscous band, the cells within the colored area finely meshed.....**Tramea**
 Hind wings not banded, the anal angle colored; the cells of the anal not small, normal in size.....**Pantala**

NANNOTHEMIS Brauer, Vern. zool.-bot. Gesellsch. Wien, p. 369, 726, 1868; Needham, Proc. U. S. Nat. Mus. 26, p. 740, 1903 (Venation).

Several species of this genus are known, but only a single one flies as far north as the Upper Austral and occasionally onto the Transition life area. If found, the species will be easily recognized from the foursided triangle. It flies in June around ponds and over marshes.

PERITHEMIS Hagen, Syn. Neur. N. Amer., p. 185, 1861; Needham, Bull. 47 N. Y. State Mus., p. 512, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus., p. 718, 1903 (Venation).

Of the several species one is found in Wisconsin.

Perithemis domitia Drury, Ex. Ent. 2, p. 83, 1773; Needham, Bull. 47 N. Y. State Mus., p. 512, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 14—15, female 13—14; h. w. male 18, female 19.

Male.—Color yellowish brown. Face brown, a green band across the middle. Thorax laterally with two pale stripes on each side. Legs brown. Wings of uniform amber color, a brown spot at the end of the triangle on all wings. Hind wings with a basal streak of brown in the sub-costal space. Costa and stigma dark brown. Abdomen uniform brown, the sides a trifle lighter. Appendages yellow.

Female.—Body similar to the male in markings. Wings white, hyaline, yellowish along the costa, a fuscous blotch at the end of the triangle reaching to the sub-costal vein, a larger blotch between the nodus and the stigma. These markings are greatly variable in size and intensity, grading from insignificant blotches to bands reaching across the whole breadth of the wings.

Life Zone: Upper and Lower Austral.

Wisconsin: Kenosha Co., Paddock's Lake, July 6, 1900.

Time and Habitat—May to August about ponds and marshes. A timid, weak species, loving the sunshine.

CELITHEMIS Hagen, Syn. Neur. N. Am., p. 147, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 742, 1903 (Venation).

This genus includes but four species, numbering among the prettiest flyers of our odomate fauna. In general they prefer the lakes for their habitat, clinging to the deep swaying rushes of the shores, though occasionally they are also found along streams. The species are easily separated by the color-pattern of the wings, which, in contrast to the preceding species, varies but slightly in intensity and extent of the markings.

1. Wings hyaline, with markings at the apices..... 2
 Wings yellow, without apical markings, a broad fuscous band traversing the wing just before the stigma.....**eponina**

2. Anal spots fuscous, divided by a yellow band.....**elisa**
 Anal spots fuscous alone, not mixed with yellow.....**fasciata**
Celithemis eponina Drury, Ill. Ex. Ins. 2, p. 86, 1773; Hagen, Syn. Neur. N. Am., p. 147, 1861; Needham, Bull. 47 N. Y. State Mus., p. 514, 1901 (Bibliography & desc. of nymph).; Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 26—27, female 24; h. w. male 33, female 32.

Male.—Colors fuscous and yellow. Thorax with a dorsal and two lateral stripes fuscous, or obsolete. Legs black, fore femora yellow beneath. Wings yellow, the nervure infuscated, stigma red, costa brown. Fore wings with basal spots; a spot filling the triangle, the supratrangular space and part of the sub-triangle; a series of spots on all antecubitals of the second series present or absent. Nodal spot, reaching from the sixth to seventh antecubital to the nodus and extending across the wing to near the hind margin. A further band from the fourth or fifth postcubital to the stigma reaching across the wing to the hind margin. The hind wing differs by having the spot of the triangle originating from the extreme base of the wing and a round spot in the anal angle. The spots vary in form, but are always present. Abdomen brown, the apical segments black. Yellow spots on dorsum of segments 1—7 and sides of 1—5. Segments 8—10 black. Appendages yellow.

Female.—Generally similar to the male. Usually the nodal spot is broken, the wings are more uniformly tinged with yellow, the veins are not infuscated, but are yellow within the fuscous areas.

Life Zone: Upper and Lower Austral, Transition.

Wisconsin: Dane Co., June 1890, June 7, 1900; Milwaukee Co., Sept. 9, 1898, June 4, 1899, July 28, 1901, July 6-17, 1902, Sept. 1, 1904; Delafield, Aug. 15, 1902; Washington Co., Cedar Lake, Aug. 1906. Little Cedar Lake, July 29-Aug. 15, 1907.

Time and habitat—June to early September about lakes and large ponds, occasionally near rivers.

Celithemis elisa Hagen, Syn. Neur. N. Am., p. 182, 1861; Needham, Bull. 47 N. Y. State Mus., p. 515, 1901 (Bibliography & desc. of nymph).

Abd. male 22—24, female 20; h. w. male 26—28, female 26.

Male.—Colors red or yellow, markings black and fuscous. Thorax above reddish, sides yellow. A mid-dorsal stripe and two lateral stripes brown or black. Legs of red specimens black, of yellow brown. Wings hyaline, nervure brown, costa yellow, stigma red or yellow. Fore wing with a spot at the upper end of the triangle, a second between the nodus and the stigma and a third spot filling the apices of the wings, fuscous. The ante- and post-cubitals of both series of all wings infuscated. Hind wings similar, an additional fuscous area nearly filling the entire anal angle from the base of the wing to the supratrangular space; this area is divided by a broad sinuous band of yellow. Abdomen black, dorsum of 3—7 and sides of 1—5 yellow or red. Yellow specimens have the base of the abdomen fuscous. Appendages yellow. The female is similar.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., July 7, 1900; Milwaukee Co., Aug. 1, 1900, July 28, 1901, July 6, 1902, July 1, 1903; Nagowicka Lake, Aug. 20, 1901.

Time and Habitat—June to early September about lakes.

Celithemis fasciata Kirby, Trans. Zool. Soc. London 12, p. 326, 1869; Williamson, Dragonflies of Indiana, p. 320, 1900.

Abd. male 22—23, female 21; h. w. male 28, female 27.

Male.—Fuscous, with yellow markings. Thorax with an antehumeral stripe and the sides yellow. Legs black. Fore wings with black or fuscous spot at the nodus, this spot reaching back to base of the wing in two forks. A second spot between the nodus and the stigma. The apices filled with black or fuscous. Hind wings similar, an additional anal round spot. Abdomen with an interrupted dorsal stripe and lateral spots yellow.

Female.—Similar. The female differs from the male by having a dark stripe just before the apex of the wing and the extreme apex clear.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., 1900.

Time and Habitat—June to September about lakes and ponds.

SYMPETRUM Newman, Ent. Mag. 1, p. 511, 1833; Needham, Proc. U. S. Nat. Mus. 26, p. 720, 742, 1903 (Venation).

Numerically this genus is the largest of the Libellulinae, comprising about 45 species. The imagos frequent the swampy shores of lakes and rivers, but seem to like moist woods and open prairies just as well, flying in great swarms wherever they occur. They are readily distinguished even in flight, from the yellow or reddish yellow tone of their colors. The following table includes the species of the Transition and Upper Austral life areas.

- | | |
|--|--------------------|
| 1. Triangle of fore wing crossed; sub-triangle of three cells.... | 2 |
| Triangle of fore wing free; sub-triangle with a single cross-vein or entirely free..... | minusculum |
| 2. Three basal segments of the abdomen with a median transverse carina | 4 |
| Four basal segments of abdomen with a median transverse carina | corruptum |
| 3. Male superior appendages with an inferior prominent median tooth, preceded by a number of denticles; female vulvar lamina bifid..... | 4 |
| Male superior appendages with inferior denticles, no prominent tooth; female vulvar lamina emarginate or triangular, not bifid..... | 9 |
| 4. Tibiæ and tarsi yellow externally; face without a black band before the eyes..... | 5 |
| Tibiæ and tarsi entirely black; a black band before the eyes..... | 6 |
| 5. Abdomen with black markings..... | albifrons |
| Abdomen with brown and yellow markings..... | pallipes |
| 6. Wings with basal markings only..... | 7 |
| Wings with basal half yellow..... | assimilatum |
| 7. Apical fourth, or less, of the genital hamule bifid, the fissure forming a rounded notch; yellow of wings restricted to extreme base..... | 8 |

- Apical third, or more, of the genital hamule bifid, the fissure oval in shape: yellow of wings reaching to or exceeding the first antecubital, vulvar lamina of two inflated lobes, the apices divergent.....**rubicundulum**
8. Branches of the genital hamule equally long, the exterior stout, triangular, the interior slender, curved; vulvar lamina bifid, triangular, the apices divergent.....**decisa**
- Exterior branch of the genital hamule longer than the interior, the latter wider than the exterior; vulvar lamina bifid, the lobes conical contiguous to apex.....**obtrusum**
9. Yellow of wings restricted to extreme base..... 10
Yellow of wings reaching to the nodus.....**semicinctum**
10. Femora and tibiae marked with black..... 11
Femora and tibiae entirely yellow.....**vicinum**
11. Feet entirely black..... 12
Feet entirely yellow.....**costiferum**
12. Appendages black.....**scoticum**
Appendages yellow or red.....**atripes**
- Of these species five have been taken in the state and two others will probably be found in the southern portions.

Sympetrum corruptum Hagen, Syn. Neur. N. Am., p. 171, 1861; Needham, Bull. 47 N. Y. State Mus., p. 525, 1901 (Bibliography).

Abd. male and female 28; h. w. male 29—31, female 30.

Male.—Face yellow, suffused with red in older specimens, an olive band below the frons. Thorax yellowish in young specimens, an antehumeral, humeral, and two lateral stripes whitish, the lateral stripes ending below in two bright yellow spots margined in black. In older specimens the stripes become obsolete, but the spots remain. Legs with yellow and black stripes, feet black. Wings hyaline, the nervure—especially toward the costa—bright red, stigma reddish fuscous, costa red. Abdomen yellowish or red, a series of bright yellow spots on the sides of each segment. Segments 8—9 marked with black on the sides and on dorsum. Appendages bright yellow, or reddish. Appendages cylindrical, thickened apically, several inferior denticles. Young specimens are chiefly yellow, older ones become red.

Female.—The female usually retains the yellow face in age instead of becoming red, while the appendages are less often of a reddish color. Vulvar lamina very short, broadly emarginate.

Life Zone: Upper Austral.

Wisconsin: Dane Co., July 10, 1900; Milwaukee Co., June 4, 1899, June 10–July 14, 1900. Aug. 1901, July 26, 1902, July 7–17, 1903.

Time and Habitat—Lakes, rivers and moist woods from June to September.

Sympetrum assimilatulum Uhler, Proc. Acad. Nat. Sci. Phila., p. 88, 1857; Needham, Bull. 47 N. Y. State Mus., p. 524 (Bibliography).

Abd. male 25—28, female 23—27; h. w. male 28—30, female 26—29.

Male.—Colors in graded shades of yellow to reddish. Face olive to pink. Thorax reddish above, sides bright yellow. Legs black, fore femora greenish yellow beneath. Wings hyaline, nervure black, stigma reddish fuscous, costa yellow. Basal half of the wings to the nodus yellow. Abdomen yellow to red, sides with apical triangular spots on

segments 4—8, turning into an even band on 9—10. Appendages bright yellow or red.

Female.—Abdomen with the lateral spots continuous. Legs with all the femora olive beneath.

This species is usually considered as a variety of *rubicundulum*. In fact, the genital organs of both male and female of the two species are identical. Except for the yellow area of the wings there is no specific difference.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., Aug. 1900, July 10-Aug. 8, 1902, July 7-Sept. 15, 1903.

Time and Habitat—July to September in marshes and woods.

Sympetrum rubicundulum Say, Journ. Ac. Phila. 8, p. 26, 1839; Hagen, Syn. Neur. N. Am., p. 176, 1861; Needham, Bull. 47 N. Y. State Mus., p. 524, 1901 (Bibliography).

Abd. male 28, female 24—26; h. w. male 30, female 26—28.

Male.—Color yellow in young specimens, adults red. Face pink or yellow, an olive band below the frons. Thorax reddish, covered with pile, legs black, fore femora green beneath. Wings hyaline, the base filled with bright yellow, nervure black, stigma reddish, costa yellow. Abdomen yellow to red, sides of 3—9 with black spots. Appendages yellow or reddish. Genital hamule bifid, the branches equal in length, the exterior slender, acute, the interior triangular.

Female.—Similar. Abdomen with more black on the sides, all femora yellow beneath. Vulvar lamina approximated at the base, the points divergent.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co., June 1890; Milwaukee Co., June 6-Aug. 3, 1900, Aug. 3, 1901, June 22-July 22, 1902, July 10-27, 1903, Aug. 27, 1904, July 15-Sept. 1, 1907.

Time and Habitat—June to September in woods and moist places.

Sympetrum obtusum Hagen, Stettiner Ent. Zeit. 28, p. 95, 1867; Needham, Bull. 47 N. Y. State Mus., p. 525, 1901 (Bibliography).

Abd. male 24—27, female 23—24; h. w. male 25—26, female 24—25.

Male.—Yellow to red. Face of young specimens olive, of adults whitish. Thorax and body yellow to red, marked similar to *rubicundulum*. Legs black, fore femora yellow beneath. The yellow area of the wings is smaller than that of its ally. The genital organs are decidedly different from *rubicundulum*, as indicated by the tabella.

Female.—Usually of an olive brown color with a reddish tinge. This olive color separates it from *rubicundulum*, which it resembles, by the form of the vulvar lamina.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June-July, 1899, June-July, 1900, Aug. 3, 1901, June 22, 1902, July 21-27, 1903, July 15, 1905.

Time and Habitat—Lakes and rivers June to October.

Sympetrum semicinctum Say.

Marked like other species in colors ranging from yellow to red. In the yellow of the wings it resembles *assimilatum*, but it is much smaller, the abdomen measuring but 20 mm. and the hind wing 23 mm. The genital organs of the male resemble those of *vicinum*, but the female differs by having the vulvar lamina short, broad, with a straight

front margin, while *vicinum* has a triangularly formed lamina. The range of the species is the Transition and Upper Austral, and it probably will be found in parts of the state by collectors.

***Sympetrum vicinum* Hagen**, Syn. Neur. N. Am., p. 175, 1861; Needham, Bull. 47 N. Y. State Mus., p. 522, 1901 (Bibliography).

Abd. male 21—24, female 22—23; h. w. male 24—25, female 23—24.

Male.—Colors as usual, ranging from yellow to red. Face yellow or red, a broad olive band below the frons. Sides of thorax of younger specimens bright yellow. Legs entirely yellow, the claws of the feet blackish. Wings hyaline, nervure brownish, costa fuscous, stigma reddish. Abdomen yellow to red, sides marked with brown spots. Appendages lighter, cylindrical, with numerous inferior denticles. The color of the legs and the small size are distinctive.

Female.—Similar. More brown on sides of abdomen. Vulvar lamina entire, forming a right-angled triangle with angle directed outward.

Life Zone: Transition and Upper Austral.

Wisconsin: Waukesha Co., Nagowicka Lake, Aug. 20, 1900; Milwaukee Co., June 4-July 1, 1900.

Time and Habitat—Marshy ponds from August to early November.

***Sympetrum costiferum* Hagen.**

This species has as yet been found only in the Transition area. The imago is a trifle larger than *vicinum*, which it resembles, but is easily distinguished by the legs marked with yellow and black stripes and the yellow feet. The genital is distinct by having the anterior lobe with its apex bent inward. The female vulvar lamina is short, entire, somewhat rounded, the middle third emarginate. It is possible that this species will be found in the state.

***Sympetrum scoticum* Donovan.**

The present species is more Boreal in its range. It has been taken in the Northern Peninsula of Michigan and is probably to be found in some of our northern counties along the boundary. The points indicated in the table will suffice to distinguish it from its allies.

LEUCORHINIA Brittinger, SB. Akad. Wiss. Wien 4, p. 333, 1850; Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Hagen places 11 species in this genus, of which six inhabit North America, while the rest are found in Europe, and in part in Northern Asia. Because of their one prominent color-feature folk-lore has given them the name of "White-face". Like the preceding genus they love the deep reeds of the marshy shores of lakes and ponds, but are rarely seen any considerable distance from the water. The generic character mentioned in the table, that the upper sector of the triangle of the hind wing departs from the lower angle is really not quite valid as a distinctive feature. Specimens of both sexes taken in Wisconsin have come to my notice, in which the upper sector is migrated a trifle upward from the lower angle of the triangle. Still, the difficulties that this inconstancy might cause are obviated in view

of the pronounced white color of the face and the short thick stigma upon the wings of the imagoes.

1. Subtriangle of fore wings free; small species, hind wings 20—23 mm. 2
- Subtriangle of fore wings usually of three cells; larger species, hind wing 24—30 mm. 3

Males.

2. Basal segments pruinose, 6 and 7 with a narrow basal line... *frigida*
- Segments 2—7 with hastate spots, interrupted apically... *hudsonica*
3. Segment 7 with a dorsal spot. 4
- Segment 7 without a dorsal spot. *glacialis*
4. Segment 8 black on dorsum. 5
- Segment 8 with a prominent dorsal spot. *borealis*
5. Segment 7 with a prominent red spot on dorsum. *intacta*
- Segment 7 with a faint yellow line on dorsum. *proxima*

Females.

2. Segment 2 with a prominent dorsal spot, 4—7 with spots decreased to narrow bands posteriorly. *frigida*
- Segments 2—7 with hastate spots, interrupted apically... *hudsonica*
3. Dorsum of 8 black. 4
- Dorsum of 8 with a prominent red spot. *borealis*
4. Markings on dorsum of 4—7 linear. 5
- Markings on dorsum of 4—7 reduced (or obsolete) to small basal triangles. *glacialis*
5. Dorsal band interrupted at the apex, ending in a basal triangle on 7. *intacta*
- Dorsal band hardly covering the basal half of the segments. *proxima*

Leucorhinia hudsonica Selys, Revue des Odonates, p. 53, 1850; Hagen, Syn. Neur. N. Am., p. 180, 1861; Hagen, Trans. Am. Ent. Soc., 17, p. 233, 1890.

Abd. male 20—21, female 19—20; h. w. male 20—23, female 21—22.

Male.—Colors yellow and black. Labium black, labrum creamy white. Face milky white. Thorax yellow, a broad mid-dorsal stripe divided by the yellow carina, humeral and lateral sutural marks, all of irregular shape, black or fuscous. Wings hyaline, nervure fuscous, the antecubitals of all wings yellow, stigma short, fuscous, costa yellow. Fore wings with a small area within the subcostal and the median space fuscous or black. The hind wings have the fuscous in the subcostal and median space extending farther, that of the latter reaching to the anal margin of the wing, thereby forming a quite regular triangle. Legs black. Abdomen black, yellow on sides of 1 and 2, a basal point on 3; dorsum with a continuous band of hastate spots on 2—7, interrupted apically, ending in a basal triangular spot on 7. Appendages black, the superiors cylindrical, thicker at the apex, the inferiors widening apically, with a broad shallow notch.

Female.—Similar. Labium with the sides white, labrum entirely black. The band or dorsum of abdomen wider, stigma of wings a trifle longer. Vulvar lamina short, approximated, or divergent and the apices obtuse.

Life Zone: Boreal. Occasionally the imago flies into Transitional regions.

Wisconsin: Vilas Co., Divide, June 24—29, 1907.

Time and Habitat—June to August about marshy places.

Leucorhinia glacialis Hagen, Proc. Bost. Soc. Nat. Hist., 18, p. 79, 1875; Hagen, Trans. Am. Ent. Soc., 17, p. 234, 1890.

Abd. male 24—26, female 23—24; h. w. male 25—28, female 25—27.

Male.—Colors yellow and black. Labium black, a white spot at the sides, labrum creamy white, face milk white. Thorax yellowish brown, a broad mid-dorsal irregular stripe of black, divided by the yellow carina, a humeral and lateral irregular markings black. Legs black. Wings hyaline, nervure black, stigma short, fuscous to black, a yellow spot at each end in younger specimens, disappearing in fully developed imagoes. The costa at the apex yellow above, in front entirely yellow. Abdomen black, segment 2 and 3 to median transverse carina yellow, a yellow spot on the dorsum and the sides just beyond. Appendages black, the superiors cylindrical, thickened at the apex, with about seven small denticles below. Inferiors two-thirds as long, the apex with a shallow angular notch. Genital hamules bifid, the anterior branch slender, recurved, the posterior shorter, thicker, armed with bristles.

Female.—Differs from the male by the entirely black labium and labrum, the yellow thorax, the yellow spots on segments 5—7 of the abdomen, and the yellow surrounding the fuscous area of the wings. Like the male the triangular anal spot is emarginate just below the median space. The abdomen has the venter pruinose, while on the male the blue extends over the dorsum also to about the eighth segment. Vulvar lamina short, widely separated by a quadrangular notch. There seems to be some variety in regard to the vulvar scale. A female from Divide, Wis., has the laminae approximated, and the round lobes widely divergent.

Life Zone: Boreal. Possibly also Transition.

Wisconsin: Vilas Co., Divide, June 24-30, 1907.

Time and Habitat—June to August along marshy shores of lakes.

Leucorhinia proxima Hagen.

Because of the remarkable similarity of the fauna of the White Mountains of New Hampshire to that of Northern Wisconsin, as mentioned before in this paper, I feel justified in including this in the list of our Wisconsin species, as it is quite probable that it occurs within the borders of the state. The species is distinguished by the markings stated in the table. The male has the anterior branch of the genital hamule bent strongly backward, the posterior is curved inward, both branches are without bristles. The vulvar lamina of the female consist of two very short, approximated tubercules. It is possible that the one female *glacialis* referred to in the description of that species really belongs to *proxima*, but this I doubt, for the markings of the abdomen are decidedly different.

Leucorhinia intacta Hagen, Syn. Neur. N. Am., p. 179, 1861; Hagen, Trans. Am. Ent. Soc., 17, p. 235, 1890; Needham, Bull. 47, N. Y. State Mus., p. 517, 1901 (Bibliography & Desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 20—24, female 19—21; h. w. male 25—28, female 24—26.

Male.—Black, marked with yellow. Labium black, sometimes with a yellowish brown spot at the sides, labrum creamy white, face milky white. Thorax yellowish brown, an irregular mid-dorsal stripe divided by a yellow carina, antehumeral, and the lateral sutures, black. Legs black. Wings hyaline, nervure, black, stigma fuscous, costa brown. Abdomen black, the first segments chiefly yellow or orange, becoming blackened in older specimens, dorsal marks at the base of 4—7, obsolete in adults, but the round spot on 7 is always prominent and of a bright red or orange. Appendages black, the superiors cylindrical, the inferiors shorter, bifurcate.

Female.—Usually greenish yellow or bright orange, rarely black like the male. The labrum black only in the middle, the labium yellow, face whitish. Thorax brighter yellow than the male, the black markings more regular. The wings with the fuscous spots of the base surrounded by yellow, nervure fuscous. Abdomen with segments 1—3 largely yellow or orange, 4—7 with dorsal hastate spots. Vulvar lamina short, the two lobes widely separated, slender, the apices acute.

Life Zone: Boreal and Transition. Also found in parts of the Upper Austral.

Wisconsin: Dane Co., June 1890, May 25, 1902; Milwaukee Co., June 14, July 20, 1903; June 8-18, 1906; Door Co., Jacksonport, June 26, 1905.

Time and Habitat—Lakes and marshes June to July.

PACHYDIPLAX Brauer, Verh. Zool. Bot. Gesellsch. Wien, 18, p. 368, 722. 1868; Needham, Proc. U. S. Nat. Mus. 26, p. 716, 726, 727, 1903 (Venation).

A genus of a single species possessing in part the attributes of *Leucorhinia*, such as the white face. It differs, however, in other respects, the longer stigma of the wings, and the base of the wings free of black markings.

Pachydiplax longipennis Burmeister, Handbuch der Ent. 2, p. 850, 1839; Needham, Proc. U. S. Nat. Mus. 26, 763, 1903 (Venation).

Abd. male 24—26, female 23—25; h. w. male 29—30, female 31.

Male.—Mouths parts creamy white, face milk-white. Frons above and vertex steel blue. Thorax fuscous, antehumerals, humerals and three lateral stripes olive. Legs black, fore femora green beneath. Wings hyaline, nervure black, pterostigma fuscous, costa black. Wings yellow at base, the hind wings with a larger area of darker yellow at the anal margin. Hind wings of other specimens with a fuscous streak in the sub-costal and median spaces. Abdomen black, a yellow or green stripe on each side of the dorsum of 2—7, sides 1—3 largely yellow, 4—5 with a basal streak. Appendages black. Adult males usually become pruinose between the wings on the sutures, on the dorsum of the abdomen to the fifth segment inclusive and on the venter to the apex. Such specimens may also have the postnodal area of the wings dusky.

Female.—Similar to the fully colored male. Rarely pruinose. The females have less yellow at the base of the wings and no basal fuscous streaks. The vulvar lamina consist of two short, rounded, widely divergent lobes.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee river, June 1899; July 6, Aug. 1, 1900; July 7, Aug. 10, 1903.

Time and Habitat—Lakes and marshes May to August.

MESOTHEMIS Hagen, Syn. Neur. N. Am., p. 170, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 718, 719, 1903 (Venation).

Two species are referred to this genus.

1. Males 2
- Females 3
2. Superior appendages yellow *simplicicollis*
- Superior appendages black *collocata*
3. Apical black spots on segments 4—10 linear, or wanting. *collocata*
- Apical black spots on segments 4—10 quadrangular. *simplicicollis*

Mesothemis simplicicollis Say, Acad. Nat. Sci. Phila. 8, p. 28, 1839; Hagen, Syn. Neur. N. Am., p. 170, 1861; Needham, Bull. 47, N. Y. State Mus., p. 527, 1901 (Bibliography & desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 29—32, female 27—32; h. w. male 32—34, female 31—35.

Male.—Olive or green, marked with black. Face olive, thorax of the same shade, the lateral sutures with isolated black or brown marks. Legs black, fore femora green beneath, hind femora with six and tibiae with about ten long spines laid in two rows. Wings hyaline, clear, stigma light brown, costa olive. Abdomen olive or greenish yellow, all the sutures ringed with black, black spots on the apical half of segments 4—9. This description applies to young males only. As the imagoes grow older the yellow of the abdomen is overshadowed with black beginning with the apical segments. Full grown specimens become blue pruinose over the whole body, except for the apical segments of the abdomen which remain black and the yellow appendages.

Female.—Fore femora entirely olive or yellow and with an external black stripe. All other femora olive externally. Abdomen with more yellow. Vulvar lamina triangular, erect, seen as a nearly perpendicular process from the venter.

Life Zone: Upper and Lower Austral. Also in tropical regions.

Wisconsin: Dane Co., July 10, 1901, Aug. 20, 1900; Town Franklin and Milwaukee river, July 17, 1902, Aug. 10, 1903.

Time and Habitat—June to September in open places along water.

MICRATHYRIA Kirby, Trans. Zool. Soc. London, 12, p. 303, 1889.

This genus includes five or six species, of which a single one is found outside of the tropical zones. *Micrathyria berenice* has been taken in Austral regions, chiefly along the Atlantic coast, and but rarely westward from the ocean strip. The imago resembles the preceding species, the adults are black or pruinose, and if not, the markings are yellowish brown on a black background.

LADONA Needham, Can. Ent. 29, p. 144-146, 1897.

Three species are referred to this genus by Prof. Needham. The genus *Ladona* was separated from *Libellula* and erected with *exusta* as the type. *Deplanata* belongs to the southern fauna, the

two other species have been taken in the state. The genus differs from *Mesothemis* by the stouter body and the dilated basal segments of the abdomen, from *Libellula* by the short stigma and other characters mentioned in the table.

1. Dorsum of thorax with two black humerals; anal fuscous spot not including the triangle.....*julia*
- Dorsum of thorax with two white antehumerals; anal fuscous spot including the triangle.....*exusta*

Ladona julia Uhler, Acad. Nat. Sci. Phila., p. 88, 1857; Hagen, Syn. Neur. N. Am., p. 153, 1861; Needham, Bull. 47, N. Y. State Mus., p. 530, 1901 (Bibliography & desc. of nymph).

Abd. male and female 22; h. w. male 33—34, female 33.

Male.—Frons and mouth-parts bright yellow. Thorax brown, two black humeral stripes preceded each by a white antehumeral. Legs dark brown, all femora luteous. Wings hyaline, nervure, costa, and stigma brown, fore wings with two streaks in the basal and sub-costal space, hind wings with yellow between the streaks and a triangular anal spot. Abdomen with the basal segments dilated, largely yellow, a dorsal spot on each side of the mid-dorsal carina on each segment. Older specimens have hardly any markings, becoming pruinose on the thorax and the four basal segments of the abdomen. Appendages yellow.

Female.—The face without yellow. Thorax above whitish to the humerals. Abdomen with yellow, blackening with age, rarely pruinose.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., June 1900. "Inhabits Wisconsin" Hagen.

Time and Habitat—June and July about marshy ponds and lakes.

Ladona exusta Say, Journ. Ac. Sci. Phila., 8, p. 29, 1839; Hagen, Syn. Neur. N. Am., p. 155, 1861; Needham, Can. Ent. 29, p. 146, 1897; Needham, Bull. 47, N. Y. State Mus., p. 529, 1901 (Discussion of characters).

Abd. male 25, female 23; h. w. male 31—33, female 30—31.

Male.—Dark brown. Similar to the preceding species. Thorax brown, two antehumerals of white. Legs brown, the femora lighter. Wings hyaline, nervure black, stigma and costa brown, fuscous streaks in the sub-costal and basal space, hind wing the anal triangular spot covering the triangle. Some yellow about the streaks. Abdomen with a dorsal band of black and lateral spots, disappearing in adults. Appendages yellow. The anterior branch of the genital hamule, according to Prof. Needham, is bent toward the rear, on line with the abdomen, not sideways as *julia*.

Female.—Similar. More yellow on the abdomen.

Life Zone: Transition and Upper Austral.

Wisconsin: "Racine" (Hagen); Dane Co., June 1890.

Time and Habitat—Lakes and ponds in June and July.

LIBELLULA Linne, Syst. Nat. 1, p. 543, 1758; Needham, Proc. U. S. Nat. Mus. 26, p. 721, 742, 1903 (Venation).

The present genus contains many of our finest and most daring dragon-flies. From early June to late September they can be seen near the reeds and bushes of lake shores and rivers, or in moist woods, flying along with a jaunty swaggering air, or dart-

ing with flashy speed after a prospective victim. They are a fearless tribe; *L. pulchella* especially is very reckless, not in the least afraid of human beings and fairly tempting the collector by its audacity.

1. Wings without a nodal spot..... 2
 Wings with a small nodal spot on the outer side..... 10
 Wings with a large nodal spot surrounding the nodus..... 12
2. Wings with a broad basal band..... 3
 Wings with basal streaks only..... 4
3. Front brown, or black banded with brown..... **basalis**
 Front entirely black..... **odiosa**
4. Stigma bicolored..... 5
 Stigma uniformly colored..... 7
5. Stigma yellow, fuscous at outer end..... 6
 Stigma white, dark brown at the outer end..... **cyanea**
6. A yellow spot on the vertex; sub-costal space faintly yellow or not..... **comanche***
 No yellow spot on vertex; sub-costal space distinctly yellow..... **flavida***
7. Stigma long..... 8
 Stigma short, fulvous..... **saturata**
8. Stigma black..... 9
 Stigma red or yellow..... **aureipennis**
9. Apices of wings infuscated..... **incesta**
 Apices of wings clear..... **composita**
10. Wings with basal streak and an anal triangular patch, black 11
 Wings without a basal streak and an anal triangular patch..... **vibrans**
11. Costal area filled with yellow..... **quadrifasciata**
 Costal area clear, spots alternating with white..... **nodisticta**
12. Spots on all wings dark brown, or fuscous, no anal triangular patch..... 13
 Spots on all wings fulvous, costal area filled with yellow, an anal triangular patch..... **semifasciata**
13. Apices of all wings infuscated..... **pulchella**
 Apices of all wings clear..... **forensis**

*) To make clear the specific validity of *L. flavida* Hagen, *flavida* Rambur, *plumbea* Uhler, *cyanea* Fabricius and *quadrupla* Say, Prof. Calvert undertook the trouble of examining the types of the different species and of otherwise studying them thoroughly. (Ent. News, Vol. 18, p. 201-204, 1907). The results, it may be said, are final. After thorough investigation Prof. Calvert concluded that, first, *flavida* Hagen was a valid species, and, secondly, *flavida* Rambur was identical with *plumbea* Uhler, and also *cyanea* Fabr. with *quadrupla* Say. Thus we have three species: *flavida* Hagen, *flavida* Rambur (*plumbea* Uhler), and *cyanea* Fabr. (*quadrupla* Say.) The second species, hitherto called *plumbea* Uhler had to receive the name of *flavida* Ramb. because of the priority of the latter and Prof. Calvert proposed the name *comanche* for *flavida* Hagen. Thus the final result is:

comanche Calvert = *flavida* Hagen.

flavida Rambur = *plumbea* Uhler.

cyanea Fabr. = *quadrupla* Say.

Libellula basalis Say, Journ. Acad. Nat. Sci. Phila. 8, p. 23, 1839; Needham, Bull. 47, N. Y. State Mus., p. 532, 1901 (Bibliography & desc. of nymph).

Abd. male 28—32, female 28; h. w. male 39—42, female 37—29.

Male.—Color dark brown. Face black, a brown band below the frons. Thorax reddish, lighter at the mid-dorsal carina, a black humeral and lateral irregular marks on the sutures. Sides tinged with yellow. Legs black. Wings with the basal half or third fuscous, lighter at the base, milk-white beyond the fuscous area to the nodus. Stigma and costa black. Abdomen with a black mid-dorsal band flanked on each side by a yellow stripe which is blackened in older specimens.

Female.—Face light brown. Thorax brown above, a mid-dorsal stripe of yellow, humerals and lateral sutures irregularly marked with fuscous. Sides largely yellow. Legs dark brown, fore femora yellow beneath. Wings with a smaller fuscous area than the male, the apices of all wings infuscated. No white area beyond the fuscous. Abdomen flattened, dilated, yellow, a fuscous mid-dorsal stripe flanked by yellow stripes which in turn are bounded by fuscous stripes.

Life Zone: Transition and Upper Austral.

Wisconsin: Waukesha Co., Nagowicka Lake, June 1898; Milwaukee Co., July 1, 1900, July 10, Aug. 10, 1903; Dane Co., June 7, 1900; June 1890; Washington Co., Cedar Lake, Aug. 15, 1906.

Time and Habitat—Lake shores June to September.

Libellula incesta Hagen; Syn. Neur. N. Am., p. 185, 1861; Needham, Bull. 47, N. Y. State Mus., p. 533, 1901 (Bibliography).

Abd. male 36—39, female 32—34; h. w. male 40—44, female 39—40.

Male.—Color reddish brown, overlaid with purple in older specimens. Face black, a luteous band below the 20, mouth parts yellow. Thorax with a light mid-dorsal stripe, sides largely yellow, irregularly marked with black near the legs. Legs black, coxa and trochanters yellowish, anterior femora yellow beneath. Wings hyaline, clear, the apices infuscated, nervure and costa black, stigma dark brown. The nodus of the wings faintly tinged with fuscous. Abdomen with the basal segments largely brown or luteous, a mid-dorsal band of black flanked by two yellow stripes. The appendages black. These markings disappear in older specimens, which become pruinose.

Female.—Usually with more yellow than the male, the markings at least translucent through the black of age. Rarely pruinose.

Life Zone: Occurs everywhere in the Transition and Austral areas.

Wisconsin: Milwaukee Co., June 1900.

Time and Habitat—Lake shores June to September.

Libellula vibrans Fabricius, Ent. Syst. 2, p. 380, 1793; Needham, Bull. 47, N. Y. State Mus., p. 533, 1901 (Bibliography).

Abd. male 42, female 41; h. w. male 48, female 49—50.

Male.—Colors yellow and brown. Face olive, the mouth parts yellow, margined with black. Thorax above brown, black at the anterior edge, a mid-dorsal stripe of yellow, a black band on the upper half of the humeral suture, sides yellow, black near the legs. Legs black, the femora brown at the base. Wings hyaline, nervure, costa and stigma black, the sub-costal space up to the third antecubital, a small spot on the outer side of the nodus and the extreme apex of the

wings, fuscous. Abdomen with a mid-dorsal stripe of black, sides yellow. Appendages brown. Adults have the markings darkened with age, obsolete, or become pruinose.

Female.—The female retains most of the yellow markings even when old, the abdomen with more yellow, the infuscated area at the apices of the wings larger, enveloping the farther end of the stigma.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., June 1900.

Time and Habitat—Lakes and ponds June to September.

Libellula quadrimaculata Linné, Syst. Nat. 1, p. 543, 1759; Hagen, Syn. Neur. N. Am., p. 150, 1861; Needham, Bull. 47, N. Y. State Mus., p. 534, 1901 (Bibliography & desc. of nymph).

Abdomen, male and female 29—20; h. w. male 34—37, female 36.

Male.—Face olive, mouth parts yellow margined with black. Prothorax black, thorax olive or yellowish, covered with pile, the humeral and second lateral suture marked irregularly with black. Nervure and stigma black, costa lighter, costal area more or less yellow, the yellow more distinct toward the base. Fore wings with a fuscous dot at the outer side of the nodus, hind wings with an additional triangular spot from the cubital space to half of the anal margin. At its outer end the spot sends off a branch to fill the triangle and the supra-triangular space. Sometimes, but this rarely, there is a smoky patch below the stigma. Abdomen conical, the basal segments dilated, the apical segments very narrow. The color is olive or yellowish, a black band on 6—10, increasing in extent toward the apex, the sides with spots of bright yellow. Appendages black. This is the most robust of our species, stout in body, small of wing.

Female.—Differs from the male by the stouter body and wider wings.

Life Zone: Transition and Upper Austral.

Wisconsin: Dane Co.: June 1890; June 2, 1900; Milwaukee Co.: June 4, July, 1899; Aug. 1, 1900; May 22—June 21, 1902; June 4, July 27, 1903; July 1907; Door Co.: Jacksonport: June 26, 1905; Vilas Co.: Divide, June 24-30, 1907.

Time and Habitat—Lakes, rivers and moist woods May to August.

Libellula semifasciata Burmeister, Handbuch der Ent., 2, p. 862, 1839; Hagen, Syn. Neur. N. Am., p. 151, 1861; Needham, Bull. 47, N. Y. Mus., p. 535, 1901 (Bibliography).

Abd. male 26—30, female 28; h. w. male 33—37, female 35—36.

Male.—Yellowish, marked with white and black, older specimens reddish. Face of teneral yellow, adults blood-red. Thorax yellowish brown, sides with two white stripes. Legs brown, femora green beneath. Wings hyaline, of a yellow tinge, nervure and stigma red, the base of the wings, a spot surrounding the nodus, the apices of the wings including the stigma reddish brown. In addition the hind wings have a vague triangular patch at the anal margin separated from the basal streak. Abdomen yellowish, black on the dorsum of the apical segments, banded on the sides by yellow spots, which become red in older specimens. Appendages yellow.

Female.—Differs by the wider abdomen and the transparent apices of the wings. The only female I have seen has the markings of the wings of a decided brown color, darker than the male. At the stigma

a brown band crosses the wing, while the extreme apices are hyaline and yellow. Also the wings are wider than those of the male.

Life Zone: Transition and Upper Austral.

Wisconsin: Milwaukee Co., July 7, 1902; July 20, 1903.

Time and Habitat—May to early August near creeks and roadsides and in moist woods.

Libellula pulchella Drury, Ill. Exot. 1, p. 115, 1770; Hagen, Syn. Neur. N. Am., p. 153, 1861; Needham, Bull. 47, N. Y. State Mus. 26, p. 763, 536, 1901 (Bibliography & desc. of nymph); Needham Proc. U. S. Nat. Mus. 26, p. 763, 1903 (Venation).

Abd. male 32—35, female 32—33; h. w. male 42—45, female 42—43.

Male.—Brown, yellow and fuscous. Face light brown to black, a band below the frons lighter. Thorax above pale, humerals broad, fuscous, two lateral stripes of bright yellow, reduced to inferior spots in older individuals. Legs black, the base of the femora lighter. Wings hyaline, nervure brown or black, stigma black, costa lighter. All wings with a basal streak, a large nodal spot, and infuscated apices, black to fuscous, alternating with milk-white spots. The hind wings also with a white anal spot. In the fore wings the basal streak is bounded by the sub-costal vein above, by the cubital below; on the outer side the fuscous area extends to a little beyond the triangle, which is usually fuscous in the upper half. The nodal spot reaches across two thirds of the width of the wings. The hind wings differ slightly, the basal streak being broader at the base. Abdomen light brown, a yellow stripe on each side of the dorsum. Appendages dark brown to black. Adults are blackened or pruinose, the markings obscured.

Female.—Differs from the male by the more inflated abdomen and the absence of the white spots on the wings.

Life Zone: Transition and Austral zones. Distribution encompassing entire North America.

Wisconsin: Dane Co., June 1890; June 7, 1901; Milwaukee Co., June 4, 1899; July 1-10, 1900; July 1-8, 1901; July 10, Sept. 30, 1903; Aug. 1-15, 1907. This is our commonest *Libellula*, and occurs practically in all parts of the State.

Time and Habitat—June to August along rivers, creeks and roadsides, in woods, fields and open places.

PLATHEMIS Hagen, Syn. Neur. N. Am., p. 149, 1861.

A single species is known.

Plathemis lydia Drury, Ill. Exot. Ent. 1, p. 112, 1770; Hagen, Syn. Neur. N. Am., p. 149, 1861; Needham, Bull. 47, N. Y. State Mus., p. 536, 1901 (Bibliography & desc. of nymph).

Abd. male 27—28, female 25—26; h. w. male and female 33.

Male.—Color brown. Face brown, mouth parts lighter. Thorax above pale, some irregular humeral spots of brown, sides with two white stripes ending in bright yellow below. Wings hyaline, nervure, costa and stigma black. The fore wings with a fuscous basal streak bounded above and below by the sub-costal and cubital space, reaching to the base of the triangle, the latter clear. A broad fuscous band beginning a little distance before the nodus and extending to the middle of the stigma crossing the wing to the posterior margin. Hind wings similar, but the basal streak envelops the triangle and is followed by a milk-white anal spot. Apices of all wings clear. Legs brown, femora

lighter. Abdomen light brown or yellowish, oblique triangular spots on each side of the dorsum.

Female.—With similar body markings. Wings with the basal streaks like the male, leaving the triangle of the fore wing clear, and filling that of the hind wing. A large nodal spot and the apices of all wings fuscous. The imago in flight resembles puchella greatly, but is distinguished by the smaller size and the oblique white spots on the abdominal segments.

Life Zone: Found everywhere in the Transition and Austral areas.

Wisconsin: Dane Co., June 1890; July 10, 1901; Milwaukee Co., Aug. 12, 1898; June 10, 1899; July 1-6, 1900; July 1, 1900; June 15, 1902; June 7, July 10, 1903. Very common.

Time and Habitat—Ponds, marshy woods and open places from May to August.

TRAMEA Hagen, Syn. Neur. N. Am., p. 143, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 728, 742, 752, 1903 (Venation).

A genus of over thirty species, of which four occur in the Austral life areas. The imagoes are strong and rapid fliers, due to the large expanse of wing. They are distinguished from all other Odonata by the very broad hind wings, from one-third to nearly one-half as wide as long at the base, and the large fuscous or black spot at the anal angle. Wherever they occur they are not at all rare, but are very difficult to capture because of their great wariness and the rapidity of their flight. In their habits they are much like other Libellulinae, showing no preference for any particular habitage, but frequenting lakes and ponds with the same fond assurance that carries them triumphantly over fields and along wooded roadsides.

1. Color of body and anal blotch brown or reddish..... 2
Color of body and blotch black; stigma black.....*lacerata*
2. Anal blotch not attaining the costa, divided by the clear basilar space; stigma fuscous..... 3
Anal blotch entire, reaching the costa; stigma red or orange.....*carolina*
3. Anal spot yellowish; stigma small.....*chinensis*
Anal spot fuscous, stigma long.....*onusta*

Tramea lacerata Hagen, Syn. Neur. N. Am., p. 145, 1861; Needham, Bull. 47, N. Y. State Mus., p. 539, 1901 (Bibliography & desc. of nymph).

Abd. male 35—36, female 35—37; h. w. male 45—47, female 44; width at base 19.

Male.—Adults black mixed with brown. Face brown, banded with black. Frons above and vertex metallic dark blue or purple. Thorax black above, lighter on the sides, lateral sutures marked with black. Legs black. Wings hyaline, nervure black, brown toward the costa, stigma short, blackish. Fore wings with a short streak and a small triangular spot at the extreme base. Hind wings widening toward the base, a large spot at the basal fourth black or fuscous, leaving the basilar space clear, and with a deep incision at the middle of the anal margin. Abdomen blackish brown, darkest at the apices of the seg-

ments, appendages black; the superiors as long as the two apical segments, cylindrical, the apical half denticulated inferiorly. Hamule longer than the genital lobe.

Female.—Similar. The face yellowish, the frons above metallic blue, the vertex yellow. Femora brown, abdomen with yellow dorsal spots, vulvar lamina bilobed, the lobes widening apically, one half the length of 9, appendages as long as 8 and 9.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., June 1900.

Time and Habitat—June to September. About ponds, lakes and open places.

Tramea carolina Linneé, Cent. Ins., p. 28, 1763; Hagen, Syn. Neur. N. Am., p. 143, 1861; Needham, Bull. 47, N. Y. State Mus., p. 538, 1901 (Bibliography & desc. of nymph).

Abd. male 33, female 35; h. w. male 43—45, female 43; width at base 17—18.

Male.—Color brown. Face yellow, frons above and vertex metallic blue. Thorax legs, abdomen and anal spot on the wings brown. The species has some resemblance to *lacerata*. A marked distinctive feature is that the hyaline anal incision into the brown spot on the hind wings enters only one-fourth of the width of the brown band, not two-thirds as *lacerata*. The latter moreover has the outer side of the fuscous area twice strongly angulated, the upper, smaller angulation on the upper sector of the triangle, the other larger angle on the cubital vein. *Carolina* is angulated strongly only on the upper sector of the triangle. The stigma is shorter, yellow or orange, the veins toward the costa reddish yellow. Superior appendages longer than 9 and 10, the genital lobe and hamule equal in length.

Female.—Similar. The appendages longer than 8 and 9, vulvar lamina a trifle shorter than 9.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., May 22, 1902; Aug. 1, 1903.

Time and Habitat—May to September about lakes, ponds, in woods and open places.

PANTALA Hagen, Syn. Neur. N. Am., p. 141, 1861; Needham, Proc. U. S. Nat. Mus. 26, p. 721, 1903 (Venation).

Like their allies of the preceding genus the two species of *Pantala* are restive fliers and not easily captured, winging themselves along at great speed, often at a considerable distance above the ground. They are not discriminative in choice of their surroundings, imitating their relatives in this respect also. From *Tramea* they are distinguished by the clear wings of one species and the diminutive anal spot of the other. The imagoes are less abundant than their relatives of *Tramea*.

1. Anal margin flavescent, no anal spot.....**flavescens**
- Anal margin with a distinct fuscous spot.....**hymenea**

Pantala flavescens Fabricius, Ent. Syst. Suppl., p. 285, 1798; Hagen, Syn. Neur. N. Am., p. 142, 1861; Needham, Bull. 47, N. Y. State Mus., p. 539, 1901 (Bibliography & desc. of nymph); Needham, Proc. U. S. Nat. Mus. 26, p. 764, 1903 (Venation).

Abd. male 32—33, female 35; h. w. male 41—42, female 42, width at base 16—17.

Male.—Colors yellow and olive, markings black. Face bright yellow, adults suffused with red. Thorax olive, covered with short hair. Legs black, anterior femora yellow beneath. Wings hyaline, nervure reddish, the costa and stigma bright red. Extreme apices of all wings and the anal margin of the hind wings flavescent. Abdomen olive in teneral, adults bright yellow basally, darkened on the apical segments, a faint black line on the dorsum of 1—4, developed into broader angular spots on 5—10. Appendages black, yellow at the base.

Female.—Face olive, wings with the apices hardly tinged, stigma and costa yellow.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., July 1899; Aug. 24, 1904.

Time and Habitat—July to September near rivers, lakes, ponds, in woods and open places. A cosmopolite.

Pantala hymenea Say, Journ. Ac. Sci. Phila. 8, p. 18, 1839; Hagen, Syn. Neur. N. Am., p. 142, 1861; Calvert, Proc. Cal. Ac. Sci. 4, p. 512, 1895; Kellicott, Dragon-flies of Ohio, p. 93, 1899; Williamson, Dragon-flies of Indiana, p. 315, 1900.

Abd. male 32, female 31; h. w. male 42, female 41—42.

Male.—Color reddish brown. Front red, mouth parts fuscous. Thorax brown, legs fuscous, all femora yellow externally, anterior tibiae with an external line of yellow. Wings hyaline, nervure brown, costa and stigma brown. Hind wings with a round anal spot fuscous. Abdomen brown, the apical segments with angular dorsal spots fuscous. Appendages yellowish.

Female.—Similar. Stigma of the wings lighter.

Life Zone: Upper and Lower Austral.

Wisconsin: Milwaukee Co., July 12, 1898.

Time and Habitat—Fields, woods, lakes, July to September.

AN ADDITION TO THE AVIFAUNA OF WISCONSIN.

BY HENRY L. WARD.

The Dovekie, *Alle alle*, is properly a bird of the Atlantic coast, breeding from latitude 69° northward; in winter coming south, occasionally to Long Island and New Jersey. It has been reported from Pennsylvania and Virginia on the south and from the Detroit River, Michigan, on the west as accidental occurrences.

Early in February last Dr. C. W. Beemer, of Port Washington, Wis., informed me that he had a devekie which was killed on Jan. 11th, 1908 by some boys hunting along the ice fringe of Lake Michigan at that point, and who had brought the bird to him for determination. Dr. Beemer had given it to a local taxidermist to be mounted. A few weeks later he presented the specimen to the Public Museum of the City of Milwaukee.

The sex was not determined by the taxidermist. The specimen appears to be an adult in ordinary winter plumage.

While this accidental occurrence increases the known western range of this species and adds one more to the birds recorded from Wisconsin yet it has no special significance. However, it adds another to our list of such freaks, showing how far a bird may wander from its proper habitat, as instanced previously by the Man-o'-War Bird taken in 1880 in the Milwaukee River near the city and now preserved in this museum, and of Clarke's Nutcracker taken on the edge of the city in 1875 and preserved for some years by Dr. Peckham. In these instances we have birds belonging to the Atlantic and to the Pacific coast regions and from the tropics meeting at this locality.

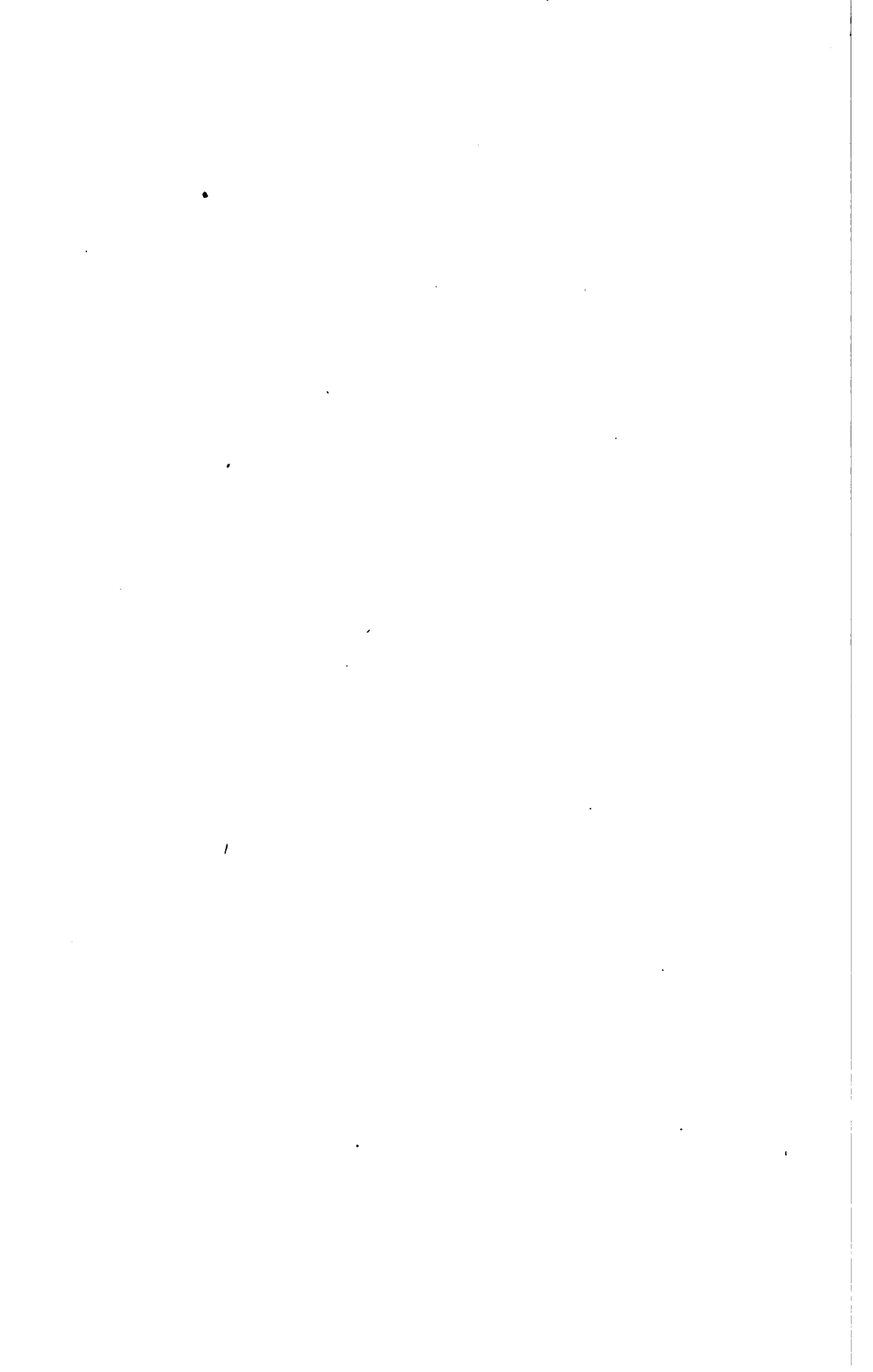
INDEX TO REVIEW OF DRAGON-FLIES.

	PAGE
abbreviatus (Gomphus).....	83
adelphus (Gomphus).....	83
æquabilis (Calopteryx).....	66
Aeschna	93, 96
Aeschnidæ	64, 79
Aeschninæ	64, 92
Agrionidæ.....	63, 67
Agrioninæ.....	64, 67
albicincta (Stomatochlora)....	102
albifrons (Sympetrum).....	108
amata (Calopteryx).....	66
americana (Hæterina).....	67
annicola (Gomphus).....	89
Amphiagrion.....	68, 73
Anax.....	93, 97
angustipennis (Calopteryx)....	66
Anisoptera.....	63, 79
anna (Enallagma).....	74
annexum (Enallagma).....	74
annulata (Macromia).....	99
Anomalagrion	68
antennatum (Enallagma).....	77
apicalis (Argia).....	72
Argia.....	68, 71
Arigomphus	84, 88
aspersum (Enallagma).....	77
assimilatum (Sympetrum).....	108
atripes (Sympetrum).....	109
auripennis (Libellula).....	117
basalis (Libellula).....	117
Basiaeschna	93
berenice (Micrathyria).....	115
bipunctulata (Argia).....	72
borealis (Gomphus).....	86
borealis (Leucorhinia).....	112
Boyeria	93
brevis (Gomphus).....	83
brevistylus (Hagenius).....	80
Calopterygidæ.....	63, 65
Calopteryginæ	64
Calopteryx	67
calverti (Enallagma).....	76
carolina (Tramea).....	64, 122
carunculatum (Enallagma).....	75

	PAGE
cavillaris (Gomphus).....	82
Celithemis	106
chinensis (Tramea).....	121
cingulata (Somatochlora).....	102
civile (Enallagma).....	77
clepsydra (Aeschna).....	97
collocata (Mesothemis).....	115
comanche (Libellula).....	117
composita (Libellula).....	117
congener (Lestes).....	69
constricta (Aeschna).....	96
Cordulegaster	79
Cordulegasterinæ.....	64, 79
Cordulia	100, 103
Corduliinæ	64, 100
cornutus (Gomphus).....	89
corruptum (Sympetrum).....	109
costiferum (Sympetrum).....	111
crassus (Gomphus).....	83
cyanea (Libellula).....	117
cynosura (Tetragoneuria).....	104
decisa (Sympetrum).....	109
deplanata (Ladona).....	115
descriptus (Gomphus).....	86
diastatops (Cordulegaster)....	79
Didymops	98
dilatatus (Gomphus).....	83
dimidiata (Calopteryx).....	66
discolor (Amphiagrion).....	73
disjunctus (Lestes).....	70
divagans (Enallagma).....	75
domitia (Perithemis).....	106
Dorocordulia	100, 103
dorsalis (Cordulegaster).....	79
doubledayi (Enallagma).....	74
Dromogomphus.....	80, 91
durum (Enallagma).....	74
ebrium (Enallagma).....	76
elisa (Celithemis).....	107
elongata (Somatochlora).....	102
Enallagma.....	68, 74
Epiaeschna.....	93, 95
Epicordulia	102
eponina (Celithemis).....	107

	PAGE		PAGE
erroneus (Cordulegaster).....	79	Libellulidæ.....	64, 98
Erythromma	68	Libellulinæ.....	64, 105
eurinus (Lestes).....	69	libera (Dorocordulia).....	103
exilis (Gomphus).....	87	lintneri (Dorocordulia).....	103
exsulans (Enallagma).....	77	olngipennis (Pachydiplax).....	114
externus (Gomphus).....	87	longipes (Anax).....	97
exusta (Ladona).....	115	lydia (Plathemis).....	120
fasciata (Celithemis).....	108	Macromia	98
fasciatus (Cordulegaster).....	79	Macromiinae.....	64, 98
flavescens (Pantala).....	122	maculatus (Cordulegaster).....	79
flavida (Libellula).....	117	Mesothemis.....	105, 115
forcipatus (Lestes).....	70	Micrathyria.....	105, 115
forensis (Libellula).....	117	militaris (Gomphus).....	83
fraternus (Gomphus).....	86	minusculum (Sympetrum).....	108
frigida (Leucorhinia).....	112	minutus (Gomphus).....	82
fumipennis (Argia).....	71	Nannothemis.....	106
furcifer (Gomphus).....	89	Nasiæschna.....	93, 95
furcillata (Gomphæschna).....	93	Nehallennia.....	68, 73
geminatum (Enallagma).....	75	Neurocordulia	100
glacialis (Leucorhinia).....	113	nodisticta (Libellula).....	117
Gomphæschna.....	93	notatus (Gomphus).....	91
Gomphinae.....	64, 80	obliquus (Cordulegaster).....	79
Gomphurus.....	84, 89	obsoleta (Neurocordulia).....	100
Gomphus.....	80, 84, 91	obtrusum (Sympetrum).....	110
gracilis (Leucorhinia).....	73	odiosa (Libellula).....	117
grafiana (Boyeria).....	94	olivaceus (Gomphus).....	83
graslinellus (Gomphus).....	87	onusta (Tramea).....	121
Hæterina.....	67	Ophiogomphus.....	81
hageni (Enallagma).....	76	Pachydiplax.....	105, 114
Hagenius	80	pacifica (Macromia).....	99
Helocordulia	101	pallidus (Gomphus).....	82
heros (Epiæschna).....	95	pallipes (Sympetrum).....	108
Herpetogomphus	80	Pantala.....	106, 122
hudsonica (Leucorhinia).....	112	penthaecantha (Aeschna).....	95
hymeneæ (Pantala).....	123	Perithemis.....	106
illinoiensis (Macromia).....	99	Petalurinae.....	64, 80
incesta (Libellula).....	118	pilipes (Gomphus).....	83
intacta (Leucorhinia).....	113	piscinarium (Enallagma).....	75
intricatus (Gomphus).....	82	plagiatus (Gomphus).....	83, 91
irene (Nehallennia).....	73	Plathemis.....	106, 120
Ischnura.....	68, 78	plumbea (Libellula).....	117
janata (Basiæschna).....	94	pollutum (Enallagma).....	78
julia (Ladona).....	116	posita (Nehallennia).....	73
junius (Anax).....	97	princeps (Epicordulia).....	102
lacerata (Tramea).....	121	Progomphus.....	80
Ladona.....	105, 115	proxima (Leucorhinia).....	113
Lanthus	80	pulchella (Libellula).....	105, 120
lentulus (Gomphus).....	82	putrida (Argia).....	72
lepida (Dorocordulia).....	103	quadricolor (Gomphus).....	85
Lestes	68	quadrinaculata (Libellula).....	119
Leucorhinia.....	105, 111	quadrupla (Libellula).....	117
Libellula.....	105, 116	rectangularis (Argia).....	70

	PAGE		PAGE
rubicundulum (Sympetrum).....	110	Sympetrum	108
rupinsulensis (Ophiogomphus) ..	81	Tachopteryx	80
saturata (Libellula).....	117	tæniolata (Macromia).....	99
saucium (Amphiagrion).....	73	tenebrosa (Somatochlora).....	101
sayi (Cordulegaster).....	79	Tetragoneuria	103
scoticum (Sympetrum).....	111	tibialis (Argia).....	72
scudderi (Gomphus).....	90	Tramea.....	64, 106, 121
sedula (Argia).....	72	transversa (Didymops).....	98
selysii (Helocordulia).....	101	tricolor (Hæterina).....	67
semiaquæa (Tetragoneuria)....	104	uhleri (Helocordulia).....	101
semicinctum (Sympetrum).....	110	uncatus (Lestes).....	70
semifasciata (Libellula).....	119	unguiculatus (Lestes).....	69
shurtleffi (Cordulia).....	103	vastus (Gomphus).....	90
signatum (Enallagma).....	77	ventricosus (Gomphus).....	99
simplicicollis (Mesothemis)....	115	verticalis (Aeschna).....	96
Somatochlora	101	verticalis (Ischnura).....	78
sordidus (Gomphus).....	85	vibrans (Libellula).....	118
spicatus (Gomphus).....	88	vicinum (Sympetrum).....	111
spiniceps (Gomphus).....	91	vigilax (Lestes).....	71
spinigera (Tetragoneuria).....	104	villosipes (Gomphus).....	88
spinosa (Tetragoneuria).....	103	vinosa (Boyeria).....	94
spinosus (Dromogomphus)	91	violacea (Argia).....	72
spoliatus (Dromogomphus).....	92	walshii (Somatochlora).....	102
Stylurus.....	84, 90	Zygoptera.....	63, 65



BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY.

Vol. 6.

OCTOBER, 1908

Nos. 3 and 4

PROCEEDINGS.

Milwaukee, April 9, 1908.

Meeting of the combined sections.

President Teller in the chair and ten members present.

The minutes of the last section meeting were read and approved.

Mr. Ward mentioned that during the winter a Dovekie (*Alle alle*) had been taken at Port Washington, which was, he believed, the most western record of the bird in the United States and the first record for Wisconsin. The bird had been presented to and was now in the Public Museum. The occurrence was of course accidental, as the species is normally confined to the Atlantic sea-coast. A note regarding the occurrence has appeared in the Auk.

M. Finger presented for discussion the suggestion that the society undertake to form a list of the plants of the state. The feasibility of obtaining the requisite data was discussed by Messrs. Graenicher, Russel, Ogden and Ward. The question was asked whether the museum would afford facilities for the storage and study of these specimens, it being understood that those acquired by the society should become the property of the museum. Mr. Ward replied that while such matters rested with the trustees he felt assured that the museum would afford all possible facilities for such work as it would be a direct benefit to it.

It was moved by Dr. Ogden and seconded by Mr. Monroe that the sections recommend to the next meeting that the president appoint a committee of four with power to add to their numbers, to take charge of and organize the work in connection with preparing a check list of the flora of Wisconsin. The motion was carried. After further informal discussion the meeting adjourned.

Milwaukee, April 30, 1908.

Regular monthly meeting of the society.

President Teller in the chair and fifty persons present.

The minutes of the regular March meeting and those of the section meeting in April were read and approved. There being no opposition, the chair appointed Messrs. Finger, Monroe, Russel, and Graenicher as a committee to take charge of and organize the work in connection with preparing a check list of the flora of Wisconsin in accordance with the recommendations of the sections.

The name of Dr. Rudolph C. Gruettner, 271, 22nd Ave., City was presented by Dr. Barth for membership and subsequently was favorably acted upon by the directors.

President Teller then introduced the speaker of the evening, Professor W. L. Tower of the University of Chicago, who spoke on "Variation, the Basic Phenomenon in Organic Evolution." Professor Tower gave a short sketch of the history of evolution, the attitude of religion and philosophy to this doctrine and its passage from a deductive to an inductive study. Variation was early recognized as being the important factor in evolution and Bacon first recognized that there were two kinds of variation, an ordinary or fluctuating one and an extreme or saltatory variation producing mutants.

The speaker made the distinction between somatic and germinal variation or that which is transmitted to offspring. Under this latter class came certain experiments of his in which he found in breeding 200,000 or more beetles of the genus *Leptinotarsus* that the offspring belonged to one series only and not to a Mendelian group; and another in which A crossed with C produced only A and C or A or C only. He called attention to the fact that what sometimes appears to be the inheritance of disease is in reality due to intrauterine infection.

He explained the peculiarities of oviposition of *Leptinotarsus* in laying a mass of eggs at one time, followed by a period during which no eggs are laid, a phenomenon repeated several times and which is convenient for the experimenter as it enables him to select any one or more of these egg-laying periods for subjecting the female to stimuli of temperature and humidity, reserving the products of other periods as checks upon the results.

The beetles if subjected to stimuli of temperature and humidity at ordinary times develop certain definite characters that are not transmissible; but if these stimuli are applied at the time of the fertilization of the ova, the resulting variation is then inherited, continuing without change for many generations. The speaker referred to experiments made by MacDougal on plants. In these he injected salts of Zinc. Cal-

cium etc. and solutions of cane sugar directly into the ovaries of many kinds of plants before fertilization has taken place. Many of these die, but in others variations are produced even in the external characters of the seeds that they develop, and these plants when bred for four or five generations continue to exhibit the variations as first produced.

Professor Tower described various of his experiments, in one of which he removed one species from within a few feet of the sea-level in Vera Cruz to an altitude of 8500 feet, thereby producing various changes in appearance and habits. Crosses of the parent form with a certain third species produced hybrids of small size which lay few eggs and these produced a predominance of males. The new variety produced from the parent form by transplanting to an increased altitude when crossed with the same third species gave large offspring laying many eggs that develop about an equal number of males and females, continuing this for many generations, thus showing that the changed environment had produced an inheritable and transmissible effect. His experiments showed that temperature, moisture and atmospheric pressure were the most important factors in producing these changes. The speaker stated that the determination of the causes of variation will be the determination of the causes of evolution. Three large cases of mounted specimens of species of *Leptinotarsus* so arranged as to graphically illustrate the results produced by altered environment and by crosses were exhibited and explained by the speaker after which they were passed among the audience for examination.

After a five minute intermission for the withdrawal of non-members, the annual meeting was called with Mr. Teller in the chair. The report of the treasurer was read and after motion was received. The president announced that owing to the absence of the secretary, his report would necessarily be omitted and that next in order would be the election of officers. Mr. Russel moved that the acting secretary be instructed to cast one ballot for all the present officers. Dr. Peckham having seconded this motion, it was put and carried, whereupon the acting secretary cast one ballot for E. E. Teller, president, Henry L. Ward, vice president, William Finger, treasurer, Charles T. Brues, general secretary and Sigmund Graenicher director.

Upon motion the meeting adjourned.

Milwaukee, May 13, 1908.

Meeting of the combined sections.

President Teller in the chair and 12 members present.

The minutes of the last section meeting were read and approved.

Mr. Russel spoke on the classification of the genus *Antennaria*. He referred to the splitting up of the group into a considerable number of species of doubtful validity, many of which he considered must be surely rated as subspecies or varieties when the forms and their geographical distribution were better known. He exhibited fresh specimens of two of the more sharply defined types showing in detail the characters which are used for their separation.

Dr. Graenicher followed with a consideration of the insect visitors of the same plants in this vicinity and those observed in Europe. This was followed by a more general discussion of the types if insect visitors which pollinate various Compositae in our region.

Milwaukee, May 27, 1908.

Regular monthly meeting of the society.

President Teller in the chair and about 60 persons present.

The minutes of the last regular monthly meeting were read and approved.

The names of J. F. Wm. Inbusch, Henry A. Koch, Bernhard S. Scheffels, and Max Griebach were proposed for membership and subsequently passed upon by the board of directors.

Mrs. H. A. J. Upham then read a paper on the geology and topography of the Dells of the Wisconsin River.

She described the topography of the country immediately surrounding this very interesting region and showed the relation of this driftless area to the surrounding glaciated country. The form of the two quartzite ranges near Kilbourn City and the way in which they have affected the drainage in the vicinity was next considered in addition to a description of several of the more interesting parts of the Dells proper. The second part of the paper was devoted to a discussion of the probable origin of the sandstone rocks, their partial metamorphosis into quartzite and subsequent weathering with final capping by more recent limestone and sandstone. The paper concluded with an explanation of the origin of this driftless area and the probable change in the course of the Wisconsin River due to the deposits of glacial drift in its former course.

The lecture was illustrated by a number of large photographs of the region.

Milwaukee, June 11, 1908.

Meeting of the combined sections.

President Teller in the chair and fifteen members present.

The minutes of the last section meeting were read and approved.

Dr. A. Ivans Comfort exhibited a number of articles made by the North American Plains Indians which he had accumulated many years ago while stationed at various military posts in the middle west. He related a number of his experiences as exemplifying certain traits of the Indians and spoke particularly of their verbal and sign languages.

Mr. Colles exhibited some specimens of rocks from southwestern Wisconsin near Prairie du Chien and referred to the stratigraphy of the vicinity. This led to a discussion and a comparison with the stratigraphy of the Milwaukee region in which Mr. Teller and several other members joined.

The meeting then adjourned.

Milwaukee, June 26, 1908.

Meeting of the combined sections.

President Teller in the chair and seven members present.

The minutes of the last regular monthly meeting were read and approved.

Mr. Russel exhibited two species of plants new to Milwaukee county.

Mr. Brues exhibited part of a collection of arctic plants from Grinnell Land, Lat. 79°, part of Ellesmere Island. With them Mr. Ward showed a series of photographs of the region and its Eskimo inhabitants. Some of the photographs showed some of the plants in bloom.

After a general examination and discussion of the plants, the meeting adjourned.

Milwaukee, July 9, 1908.

Meeting of the combined sections.

President Teller in the chair and 10 persons present.

Dr. Barth exhibited some Syrphid flies and Crabronidae, the latter selected to show the different groups into which they are divided according to Fox. He stated that about 20 species are found about Milwaukee. He described the making of their nests, manner of stinging their prey, laying of eggs, feeding of young, spinning of their cocoon and their metamorphoses.

He called attention to specimens of *Condidea lata* Coquillett, and *Spilomyia hamifera* Loew, which had not previously been reported from Milwaukee County.

Dr. Graenicher exhibited specimens of a Yellow Flax, *Linum sulcatum*, new to the flora of the county. He also reported having found *Aster Drummondi* blooming on July 1st, which from the condition of the flowers, he judged must have come out about June 25th, or about a month earlier than usual.

The meeting then adjourned.

Milwaukee, August 13, 1908.

Meeting of the combined sections.

Vice-president Ward in the chair and ten persons present.

Dr. Geo. P. Barth exhibited plaster casts of wasps nests he had made recently at Cedar Lake, Wis., and described the habits of some of the fossorial species shown. *Anacrabro ocellatus* which builds at the foot of a tuft of grass, a weed, stone, etc. in sand banks, preferably with sparse vegetation is unique in its digging methods. It flies along a sand bank in short arcs so as to strike the bank every few inches, and bite the ground, as if testing its workable quality. When it has found a suitable place, it sets to work, not in the usual way by picking out the earth grains, but by picking them up one at a time and flying with the load clutched between the forelegs and the depressed head to drop the load some ten inches away. Thus there is often a sand trail of such dropped particles leading towards the nest. It goes into its hole by diving into it on the wing, but usually has to make a few preliminary jerky dives as if to locate the hole it seeks to enter. Three casts of its irregular holes were shown also one cast of a hole of *Bembex spinolæ* whose general direction of the nest is 45° from the vertical; one of the great Golden Digger, *Proterosphex ichneumonea*, with its several cells leading off at right angles at or near the base of the main passage; and one of *Philanthus*, whose boring enters the bank directly.

Ichneumonea stores its nest with as many as 12 grasshoppers, in amplification of Dr. Peckham's published accounts. The finest dental plaster in twice its bulk of water was used these casts, and poured into holes of nests with a small bottle fitted with glass tubes like the chemist's wash bottle.

Mr. Ward exhibited some vegetable balls, probably the alga *Pithophora* rounded like flattened spheres, capsules and egg-shapes, formed apparently by wave action at Fox Lake, Wisconsin.

Mr. Burrill read a lecture entitled "The Home Making Work of the Federal Government," recently written by Mr. C. J. Blanchard of the U. S. Reclamation service and illustrated by about one hundred

slides beautifully colored, also loaned by the service. The subject matter reviewed the need of irrigation in the west, the government work to date, a description of the leading irrigation projects undertaken by the government, and the astonishing results in those regions already irrigated last year.

After discussion, the meeting adjourned.

Milwaukee, September 24, 1908.

Regular monthly meeting of the society.

President Teller in the chair and about fifty persons present.

• The minutes of the last regular monthly meeting were read and approved.

President Teller mentioned the needs of the society in the direction of enlarging its membership list and asked that the meeting discuss the matter.

Dr. Barth moved that a committee be appointed to look into this matter, to prepare a circular letter and mail it to persons who might be prospective members, stating the aims, needs and privileges of the society. After some discussion the motion was carried and the chair appointed Messrs. Barth, Ward, and Russel to serve on this committee.

Dr. Barth then proposed the following resolution. "Be it resolved that a committee of three members be appointed by the chair to confer with the Board of Trustees of the Public Museum relative to contributing a sum of money to assist in defraying the expense of publishing the bulletin of the society. Mr. Russel moved that the resolution be adopted; seconded.

Mr. Ward said that he thought the Board of Trustees would be glad to confer with such a committee and that he thought they might quite probably regard favorably such an arrangement. After some further discussion the motion was passed.

The names of Mr. R. A. Muttkowski of the Public Museum and Dr. Oscar Chrysler of the National Soldiers' Home were proposed for membership and subsequently elected by the board of directors.

There being no further business Mr. Alfred C. Burrill gave an illustrated talk on the Indians of Our Southwest, at the same time calling attention to the kind of lantern slide collection which the Public Museum is organizing as a stock series for public lectures. He

showed views illustrating the manners, customs and rain worship of the Pueblo indians, the Apaches and neighboring tribes with a digression to the Huichol indians of Mexico. He combatted the common opinion that the indian is naturally lazy, showing the indians of these tribes to be very thrifty and hard workers; going "back to the blanket" did not betoken indolence, but rather the adaption of the white man's education to the indian customs and civilization.

The meeting then adjourned.

NOTES ON WISCONSIN MAMMALS.

By N. HOLLISTER.

The following fragmentary notes on Wisconsin mammals are intended as supplementary to the excellent and conservative list recently published by Hartley H. T. Jackson.¹

One of the important objects of such a paper as Jackson's preliminary list is to induce others to publish any additional information they may have, that it may become available to the local workers. In determining the geographic and zonal distribution of mammals it is important to have records from as many localities as possible, even for the most common and generally distributed species. Many previously unthought-of factors regulating the distribution of a form within the state may be disclosed by a carefully prepared map of the range of the species, based upon authentic records.

Thanks are due Dr. C. Hart Merriam, Chief of the Biological Survey, for permission to publish this paper and to include records of specimens in the Survey collection.

***Didelphis virginiana* Kerr.**

Opossum.

At least three opossums have been killed in Walworth County during the past fifteen years, two of which I saw in the flesh. A fine male, killed at Delavan, October 19, 1902, is in the collection of the Biological Survey.

***Cervus canadensis* Erxleben.**

Canadian Wapiti.

Elk formerly ranged throughout southern as well as northern Wisconsin. Sections of antlers are still occasionally found in Walworth County, most frequently under marshy ground. A fine pair was taken from Delavan Lake some years ago.

Theodore Roosevelt says the elk disappeared from the region south of the Great Lakes and between the Alleghanies and the Mississippi River about the beginning of the nineteenth century

1) Bull. Wis. Nat. Hist. Soc., VI, 1-2, pp. 13-34, Apr., 1908.

but existed much longer in northern Wisconsin, northern Michigan, and Minnesota.¹ There are several reliable records for Illinois at about this period, and John Dean Caton states that the last account of their presence in northern Illinois known to him was in the year 1820 or thereabouts.² Dr. P. R. Hoy records their occurrence on the Hay River, Wisconsin, in 1863,³ and there is no reason to doubt this statement as it is well known that the animals were not infrequently killed in both Michigan and Minnesota at a still later period.

***Alce americanus* (Clinton).**

Eastern Moose.

I see no good reason for excluding the moose from a list of Wisconsin mammals. It is a well known fact that the species was formerly common in the northern part of the state, and it is not entirely an impossibility that a few will still be found there, as they are fairly plentiful in parts of Minnesota and have been killed within the past ten years in the upper peninsula of Michigan where they still occur in a number of counties. Hoy states that one was killed "near the line of the Wisconsin Central Railroad" in December, 1877.⁴

***Bison bison* (Linnaeus).**

American Buffalo.

I consider that the buffalo, like the elk and other exterminated species, is entitled to a place in a list of Wisconsin mammals. The former range has been carefully worked out and mapped by the historians of the species, notably Allen and Hornaday, and it is well known that it formerly ranged over much of the western half of the state. Furthermore, Wisconsin is now generally credited with the last buffalo east of the Mississippi River, near the St. Croix River in 1832 or 1833.⁵

***Sciurus hudsonicus minnesota* Allen.**

Minnesota Red Squirrel.

A careful review of the red squirrels of this region proves the validity of this race, to which all the Wisconsin animals belong. True *hudsonicus* apparently does not occur on the south-

1) The Deer Family, p. 132, 1903.

2) The Antelope and Deer of America, p. 80, 1877.

3) Trans. Wis. Acad. Sciences, Arts, and Letters, V, p. 256, 1882.

4) Trans. Wis. Acad. Sciences, Arts, and Letters, V, p. 256, 1882.

5) Lapham, Trans. Wis. State Agric. Soc., 1862, p. 340, 1863; Hoy, Trans. Wis. Acad. Sciences, Arts, and Letters, V, p. 256, 1882; Hornaday, Report U. S. Nat. Mus., 1886-7, map, etc., 1889.

ern shore of Lake Superior, though it reaches northern Minnesota, as attested by a specimen from Two Harbors, north of Duluth. In this connection I have examined specimens from extreme northern Wisconsin, near the line of the upper peninsula of Michigan, the western and south-central part, and the extreme southeastern corner. A specimen from Hebron, Jefferson County, is the nearest approach to *Sciurus h. loquax* but from its large size and light color is easily referable to *minnesota*, the range of which form, as defined by Dr. Allen in his original description, extends to northern Indiana.¹

***Eutamias borealis neglectus* Allen.**

Lake Superior Chipmunk.

Although apparently restricted at the present time to the most northern counties this chipmunk formerly occurred in the central portions of the state. Moses Barrett gives some interesting notes on the two species of chipmunks in central Wisconsin in the early fifties.² In the National Museum are four specimens of *neglectus* collected by Dr. E. A. Mearns at Camp Douglas, Juneau County, in 1890 and 1891.

***Citellus franklini* (Sabine).**

Franklin Spermophile.

This species is common in isolated colonies in various parts of Walworth County. I have collected many specimens near Delavan. The largest colonies here are located on Ridge Prairie, just west of town, and on the border of the Big Marsh, seven miles north of Delavan on the Whitewater road. In the former place the "gray gophers" do considerable damage in the grain fields and have greatly increased in numbers in recent years. On the Big Marsh I once shot one from a considerable height in a tamarack tree, mistaking it for a gray squirrel.

The Biological Survey also has records of this species from Janesville, Kansasville, Madison, Plover, Racine, Ripon, and Whitewater.

***Castor canadensis* Kuhl.**

Beaver.

The beaver was not always confined to the northern counties but occurred in the early days over much of the state. Lapham states that "the last beaver killed, in the southern part of Wisconsin, was in 1819, on Sugar Creek, Walworth County, a very large one."³

1) Am. Naturalist, XXXIII, p. 640, Aug., 1899.

2) Am. Naturalist, VII, p. 693, Nov., 1873.

3) Trans. Wis. State Agric. Soc., 1852, p. 339, 1853.

***Peromyscus bairdi* (Hoy & Kennicott).**

Michigan White-footed Mouse.

This mouse is found in the vicinity of Lake Michigan north at least to Racine, where Vernon Bailey captured two specimens April 20, 1898. These are now in the Biological Survey collection. In Walworth County it is abundant and I have collected many specimens at Delavan.

***Zapus hudsonius* (Zimmermann).**

Jumping Mouse.

Additional records for *Zapus* are furnished by specimens from Racine and Delavan. The Racine specimen is in the National Museum and has been previously recorded by Preble.¹ A Delavan specimen, in the Biological Survey collection, was taken by myself October 9, 1908. While hunting for a wounded mallard in the marsh at the upper end of Lake Como, near Delavan, I started the mouse from a grassy bog. He seemed somewhat dazed by the bright sunlight and I managed to capture him by a lucky stroke with my hunting cap. Another specimen was also collected near Delavan by Charles Besecker of that place and I believe one was captured a number of years ago at Milton by R. W. Clarke.

***Urocyon cinereoargenteus ocythous* Bangs.**

Wisconsin Gray Fox.

Two typical specimens of this fine fox, collected by myself at Delavan, are in the collection of the Biological Survey. Both are males; they were killed January 13, 1900 and November 15, 1903.

***Vulpes fulvus* (Desmarest).**

Red Fox.

In the Biological Survey collection are specimens of the eastern red fox from Eagle River, Vilas County; and Delavan, Walworth County. The Eagle River specimen was killed February 9, 1908, and the Delavan specimens, a male and female, were captured January 24, 1899 and November 28, 1903.

1) N. A. Fauna, No. 15, p. 17, 1899.

Canis latrans* Say.*Coyote.**

The range of the prairie wolf extends northward to the northern border of the state. The Biological Survey collection contains three skulls collected near Eagle River, Vilas County, March 10, October 5, and November 2, 1907. In the southern part of the state, notably in Walworth County, it is probably increasing in numbers and several litters of young are taken each year. A fine male, skin and skull, from Delavan, December 12, 1898, is also in the collection.

Felis cougar* Kerr.*Panther.**

In the absence of any recent accounts of an animal which undoubtedly occurred in Wisconsin in the early days I see no good reason why Dr. Hoy's record should not be perpetuated in any Wisconsin list. He states that Benjamin Bones of Racine shot one on the headwaters of Black River, December, 1863.¹

Mephitis mesomelas avia* Bangs*Illinois Skunk.**

In the Biological Survey collection are three specimens of this species from Delavan, a female, December 6, 1902; male, January 28, 1903; and male, January 6, 1904. The species occurs here with *Mephitis hudsonica* but is not common like that species. Out of twenty-eight skunks collected near Delavan, twenty-five are *hudsonica* and only three *avia*. All have been determined by A. H. Howell.

Taxidea taxus* (Schreber).*Badger.**

Several badgers have been recently captured in Walworth County. The Biological Survey collection contains a fine specimen killed at Delavan, January 4, 1904.

Gulo luscus* (Linnæus).*Wolverine.**

As in the case of the panther the only specific account of a capture of this animal in the state that I am aware of is that given by Hoy. He writes that wolverines are occasionally taken in the

1) Trans. Wis. Acad. of Sciences, Arts, and Letters, V, p. 256, 1882.

timber and that one was captured in La Crosse County in 1870. These records are certainly worthy of mention in any general account of Wisconsin mammals.

***Sorex fumeus* Miller.**

Smoky Shrew.

A specimen of this species from Racine is in the National Museum collection. It has already been recorded by Miller.¹ Persistent trapping will undoubtedly produce other specimens from northern localities within the state.

***Scalopus aquaticus machrinus* (Rafinesque).**

Large-nosed Mole.

A specimen of this species was collected at Camp Douglas, Juneau County, Wisconsin, by Dr. E. A. Mearns, U. S. A. It was examined by Dr. F. W. True in connection with his work on the American moles and recorded in his revision of the group.²

***Myotis subulatus* (Say.)**

Say Bat.

In the United States National Museum collection is an alcoholic specimen of this species collected by J. W. Milner at Bayfield, Wisconsin, which has already been recorded by Miller.³ While ordinarily not so abundant as *Myotis lucifugus* this bat doubtless regularly occurs in Wisconsin, as this region is in the center of its area of distribution and it has been captured on all sides of the state, as notably at Elk River, Minnesota; Chicago, Illinois;⁴ and Porcupine Mountains, Michigan.⁵

***Lasiurus cinereus* (Beauvois).**

Hoary Bat.

An additional record for this bat in the state is furnished by a female specimen in the Biological Survey collection collected by myself at Delavan, July 6, 1901. It is rare here at that season, usually arriving from the north in September.

1) N. A. Fauna, No. 10, pp. 33 and 50, 1895.

2) Proc. U. S. Nat. Mus., XIX, pp. 26 and 31, 1896.

3) N. A. Fauna, No. 13, p. 76, 1897.

4) Miller, N. A. Fauna, No. 13, p. 76, 1897.

5) Adams, Ecological Survey in Northern Michigan, p. 131, 1906.

THE LAST RECORDS OF DEER IN WALWORTH COUNTY, WISCONSIN.

BY N. HOLLISTER.

Authentic accounts of any of the larger mammals in central or southern Wisconsin are of great value and must be collected soon if they are to be preserved with accuracy as to dates and circumstances. Many species are already gone from the entire state and of some of these there is not a local specimen in existence nor a specific record in literature. Even in the extreme northern counties conspicuous species are now rapidly disappearing and each record of their occurrence or capture is worthy of note.

Wild deer were exterminated in southeastern Wisconsin nearly sixty years ago. During various visits at home in the past few years I have been collecting from some of the older residents data relating to their occurrence in the vicinity of Delavan, Walworth County, and believe that the information thus gathered will prove of interest.

Deer were formerly abundant in Walworth County and in the early forties plenty still remained. The late Silas Bowker of Delavan told me of often seeing numbers of them between Delavan Lake and Geneva Lake, which locality he claimed was the best deer country in Walworth County. Others tell of many in the northwestern part of the county, and it seems probable that though deer were generally distributed throughout the county the vicinities of Delavan Lake and Richmond were their favorite resorts. I. P. Larnard, of Delavan, tells me that Wm. Hollister, deceased, saw about fifty in one herd on the edge of the Big Marsh, between Delavan and Whitewater, in 1842.

After this date the deer rapidly decreased. Mr. Larnard states that they soon left the lake woods and Richmond, and never returned in any numbers. In September, 1846, Mr. Larnard shot one from a bunch of five or six in what is now Isham's Grove, on the outskirts of Delavan. After killing this one he rapidly loaded his rifle and snapped three caps in an endeavor to shoot a fine buck which came out and stood in plain sight during the whole performance but trotted off, to his great disgust, before he could find a cap which would explode. This, Mr. Larnard believes, was

the last deer killed in the vicinity of Delavan, though a few were seen from time to time during the next few years. Mr. Larnard was a keen sportsman in those days and probably kept better account of such matters in that region than any man now living.

In 1849 or 1850, my father, K. N. Hollister, and his brother, U. S. Hollister, saw three deer in the Big Woods, five miles west of Delavan, and a year or two later saw two more crossing Rock Prairie and taking to the woods near the same place. A. B. Hare, of Delavan, last saw deer at Lake Nine, Richmond, as nearly as he can figure, in 1852; and Jas. H. Camp, also of Delavan, says that two deer were seen in the park at Elkhorn one morning in 1852 by a Mr. Bradley, who was then postmaster at that place and is still living. The park was much larger then and, of course, in a wilder state.

From all accounts, then, 1846 may be taken as the date for the last deer killed and 1852 for the last deer seen in the vicinity of Delavan.

THE AMERICAN ELK IN SOUTHERN WISCONSIN.

BY HENRY L. WARD.

This, the most stately American representative of the deer family, has within the present generation of men given way before the changes wrought by an increasing population and exploitation and has presumably become quite exterminated from Wisconsin's soil although from the fact that some are reputed to still exist in Minnesota it would not be altogether surprising should a straggler now and then cross the boundary.

The tempermental qualities of the animal which deter it from, at the first suspicion of danger, seeking safety in flight but cause it to linger until assured that its life is really menaced has rendered it less fit in the struggle for existence than is its smaller, more nervous, relative of this region, the white-tailed or Virginian deer; and thus its numbers and range have been more rapidly restricted.

In 1881 Judge Caton (1) wrote of it: "But few quadrupeds in our country have occupied a wider range than the American Elk. He was found in every part of the present United States and in northern Mexico; and was abundant in both Upper and Lower Canada, and in Labrador. In the interior, he was found as far north as the fifty-sixth or fifty-seventh degree of north latitude; but I can not find any evidence that he ever went so far north on either coast. The last account I get of their presence in northern Illinois was in the year 1820 or thereabouts. Till comparatively recent times they were found in northern Iowa, and in 1877 I saw several accounts of them having been killed in the northern part of the lower peninsula of Michigan, also in Minnesota."

In 1882 Dr. P. R. Hoy (2) wrote: "Elk, *Cervus canadensis*, were on Hay River in 1863, and I have but little doubt that a few still linger with us. The next to follow the buffalo, antelope and reindeer."

Moses Strong (3) in 1883 wrote of the elk: "Occurs very rarely in northern and central Wisconsin. It was formerly quite numerous, but is now almost extinct."

Mr. Hartley H. T. Jackson (4) writes: "The elk is without doubt now extinct in Wisconsin, but cast-off antlers scattered throughout the lakes, marshes and woods of northern Wisconsin attests of its former occurrence there. I have examined antlers of *Cervus canadensis* found in Ashland and Iron Counties."

Presumably antlers and other remains of this deer have been found in many parts of southern and central Wisconsin, but their occurrence seems not to have been noted in publications which zoologists would naturally consult, therefore I have thought it desirable to here put on record two occurrences from the southern part of the state.

In or before 1889 the museum received from Mr. Fred. Miller a portion of an antler, probably cast, that was dug up four feet below the surface at Miller's Brewery in Wauwatosa a few miles west of this city.

In 1899 Mr. Frank Clark plowed up on his farm in Pewaukee, near the river, a pair of cast antlers. These were recently presented by his widow, to Mr. Stanley G. Haskins who has since given them to the Public Museum. The antlers were originally of good size but are now considerably reduced by complete loss of some of the tines and the loss of the ends of all but one of the others and the cutting off of the distal half of one antler, probably by the plow that brought it to the surface. Their loss of animal matter seems to have progressed as far as is common to mastodon bones recovered from eastern marshes; carrying conviction that the antlers have lain buried many years. Minute root plants have penetrated the cellular tissues exposed by the removal of the ends of the tines.

It would be of interest should some one, having the requisite time at their disposal, collect the credible references to the occurrence of the elk living in Wisconsin that presumably are embodied in many historical works, narratives of early voyages, settlers, etc. The work might be fraught with some difficulty as this as well as the buck of the white-tailed deer have frequently been called Stag.

1. The Antelope and Deer of America, John Dean Caton, pps. 78—80.

2. Dr. P. R. Hoy. The Larger Wild Animals That Have Become Extinct in Wisconsin, Trans. Wisconsin Acad. Sciences, Arts and Letters, Vol. V, p. 256.

3. List of the Mammals of Wisconsin by Moses Strong in Geology of Wisconsin, Vol. 1, p. 437.

4. A Preliminary List of Wisconsin Mammals, Hartley H. T. Jackson, Bull. Wisconsin Nat. Hist. Soc., Vol. 6, p. 15, (Apr. 1908.)

THE NESTING OF ANACRABRO OCELLATUS PACK.

BY GEORGE P. BARTH.

This little wasp, from six to seven and one half millimeters or about one-quarter inch in length, is very common on the umbelliferous and composite flowers about Milwaukee during the month of July, August and early September. It is easily recognized by its compact form, rather rough, granulated exterior, sharply pointed abdomen concave below and convex above, with five sharply pointed triangular yellow spots on each side, and a line of yellow on the metanotum.

Although very numerous the nesting site of the insect seems to be hard to find as very diligent search has thus far failed to reveal any nests in the immediate vicinity of the city. It was my good fortune however, to have my attention called to a considerable colony in a sand bank near the shore of Cedar Lake, Washington Co., Wis.,—about thirty miles from Milwaukee—and here the notes following were taken.

Anacrabro begins nesting labors about the middle of July but does not begin storing until a week or two later, as several nests dug up before July 22nd showed no cell formation or storing. After that date nidification is in full swing.

The first illustration shows what is evidently the typical nesting site of this wasp—a moderately large sand bank sparsely covered with tufts of grass and flowering plants and fully exposed to the heat of the sun's rays.

Such banks usually are literally alive with a host of insects, generally digger wasps, eagerly, nay fiercely active on hot bright days in their efforts to obey nature's mandate: to provide for the perpetuation of their species by the building and storing of nests. To a nature lover the sight presented gives the keenest enjoyment and abundant opportunity to indulge in that speculative philosophy which holds him enthralled for evermore when once his interest is awakened.

Among the busy workers Anacrabro is easily recognized by certain peculiarities or characteristic actions which mark her advent upon the scene. Unlike most fossorial she does not alight and furiously attack the sand by scratching and gnawing but in a gentle, dainty manner approaches the bank on the wing and alights just long enough to give a discrete 'peck' and mayhap, the

place being unsuited to her taste, flies along the bank in arcs testing in like manner every few inches until her fastidiousness is satisfied as to the character of the soil. Usually the spot chosen is at the base of a tussock of vegetation though she is not averse to a level expanse of sand, the edge of a small stone or the base of a four inch cliff.

Having decided on a location the wasp begins the actual labor of excavation and herein again lies a peculiarity which, as far as I have observed, is characteristic of *Anacrabro* as opposed to other digger wasps of this region. She bites off a piece of earth and flying backwards from six to eighteen inches, drops it and dives forwards again for more, this to and fro flight taking place very rapidly and with great regularity without the insect turning about in its excursion—in other words, the insect always faces the nest, the backward flight being started by a backward jump from the ground and is not accompanied by an audible hum. The ground is not thrown but dropped, the momentum of the flight and its sudden termination being sufficient to transfer it in parabolic curve to some distance from the nest, in one case showers of sand falling over my book as I wrote though fully three feet from the nest. In no case was the insect seen to assist in the loosening of earth by scratching. Having penetrated to some distance the method of approach, or rather the rhythm, is altered in that it at times becomes jerky in character. One, two or even three momentary halts, each one nearer the entrance may be made before the wasp disappears within. The purpose of this manoeuvre appears to be to assure an accurate entrance into the nest as in no case was the wasp seen to alight and enter by crawling. In one case in which the nest was located at the foot of a cliff and the entrance gallery almost paralleled its base, the insect repeatedly struck the side just within the door, often with such force as to send her rolling down the bank. Again and again she flew back to renew the attempt each failure being accompanied by an angry buzz and with every appearance of great annoyance. Discouraged at last by the frequent repetition of this mishap she abandoned the nest after tunnelling about one inch, the intelligence of the insect evidently being not great enough to overcome the difficulty. That this method of entering the nest is instinctive was shown in practically all cases. Especially evident did it become on one rather windy day. The wasps were repeatedly blown from the straight path to the nest generally missing the opening by a very short distance. It certainly would have been far easier to alight and walk into the nest, always less than half



NESTING SITE OF ANACRABRO OCELLATUS PACK.
AT CEDAR LAKE, WASHINGTON CO., WIS.

One hundred and eighteen loads in twenty-nine and one-half minutes or over four to the minute! Certainly very rapid work considering that she covers from one to three feet in flight with each load! And this number in but twenty-nine minutes of a working day of over nine hours! (I have seen Anacrabro still working at 7:45 P. M.). During her prolonged stays in the nest she probably brings the excavated material nearer the door although this could not be determined. While she was still in view each load was carried out as soon as loosened, the mandibles only being used to dig. The backward and forward path of flight rarely varies more than a few inches in lateral direction, and its limit is from four to eighteen inches. In one case a ridge of sand could be traced beginning two inches from the nest and extending over two feet. Anacrabro is quite lazy as far as early morning hours are concerned, rarely beginning work before ten o'clock though the sun be bright and hot and shine directly on the nest. She compensates however by working well into twilight.

In all but one of the twenty-odd nests examined the entrance proceeded from two to six centimeters slightly inclined and shallowly underneath the surface and then took a rather abrupt bend down into the sand. In the exception the nest entered a bluff of a mixture of clay and sand and maintained a curved course from the beginning. The first or horizontal portion was usually fairly straight, about six millimeters in diameter but the descending gallery often pursued so tortuous a course as it proceeded between and around stones and obstructions that it would have been well-nigh impossible to follow it without assistance obtained by first filling the nest with plaster of Paris cream. This part varied from four to seven millimeters in diameter, the normal evidently being six as this was maintained where no obstruction was met. The number of cells in a nest is proportionate with its age. The terminal portion of the gallery is fashioned into a cell, stored and walled off. The further enlargement of the nest takes place in one of two ways. Either a short portion of the gallery above this cell is filled in and the tunneling continued in a new direction beyond it (vide Nest 4) or short tunnels are built laterally from the main gallery and proximal to the end cell, the ends of these again being formed into cells, stored and closed off. (vide Nest 3). This would agree in general with the usual plan of the nests of other members of the Crabro family except that in none of the Anacrabro nests was there a row of cells, a very common occurrence with other members of the family. The cells average seven by thirteen millimeters in size, elongate—oval in

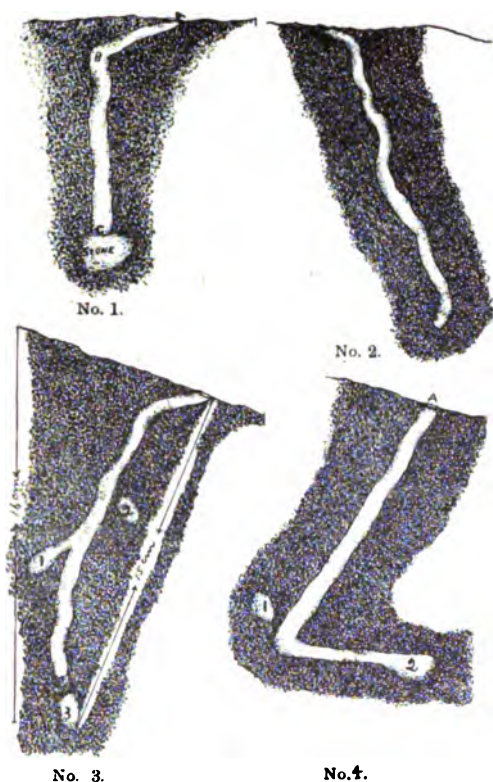


No. 6.



No. 5.

PLASTER FILLED NESTS OF ANACRABRO OCELLATUS PACK., SHOWN IN THEIR NATURAL LOCATION.



EXPLANATION OF FIGURES.

Nest No. 1.—An unfinished nest which stopped abruptly at the stone.

A to B—2 c. m. B to C—4 c. m. Diam at B—5 mm.

Nest No. 2.—An unfinished nest $\frac{1}{3}$ natural size.

Nest No. 3.—Cell 1 contained four *Lygus pratensis* Linn. but was not closed off. Evidently not completely stored; cell 2 contained four bugs and was closed off; no egg; cell 3 contained 7 bugs and an egg. $\frac{1}{3}$ natural size.

Nest No. 4.—Cell 1 contained a number of the *Lygus* which were being eaten by ants of the genus *Monomorium*. Cell 2, a terminal cell 7x13 mm. $\frac{1}{3}$ natural size.

shape and are stored with from four to seven adult *Lygus pratensis* Linn. In one of the nests (No. 7) the peculiarity of two entrances was offered, they being about two centimeters apart, the gallery of the one two and a half, of the other, three and a half centimeters long. They then met and continued as one gallery for the remainder of the nest. I can offer no explanation of this unless it happened by accident as no stone or other obstruction existed between the two entrances. Long and careful watching showed that but one insect occupied the nest. In her work of excavation this insect always entered through the longer gallery and always came out through the shorter with her load. Possibly the original entrance to the nest was closed by a disturbance of the sand about it and the returning wasp, not finding the door where she knew it ought to be, started a new nest in the immediate vicinity and, guided by a nest odor, dug in the direction of the old gallery till a connection with the old nest was formed. Her activities in the nest may then have caused the barrier in the old door to cave in and, consequently, a re-opening of the original entrance. In a number of cases where the nest had been filled with the plaster cream but not immediately dug out, the owner of the nest at once started a new tunnel beside the rather large cap of hardened plaster which is formed on the surface after the nest is full, which tunnel proceeded directly in line and close beside the plaster cast of the old gallery.

The time which the wasp takes to capture and return with its very common prey is comparatively short, as could be expected since it is found abundantly on almost any of the flowering plants. The following observations will serve as an example of the duration of the hunting expeditions:—

Left at 10:37. Returned at 10:39:10 with prey (2 min. 10 sec.)

Left at 2:48. Returned at 3:4 with prey (16 min.)

Left at 3:54:0. Returned at 3:14:30 with prey (8 min. 50 sec.)

Left at 3:16. Returned at 3:28:10 with prey (12 min. 10 sec.)

Left at 3:30:20. Returned at 3:38 with prey (7 min. 40 sec.)

The bug is firmly pressed into the concavity of the abdomen and against the thorax by the middle and hind legs, the abdomen being curved down over it. This makes it rather difficult to decide whether she is carrying or not. Without halt she darts directly into the entrance giving the impression of a tumbling down the gallery. Whether the prey is shifted was not determined as her disappearance into the nest was too rapid for such observation. In this she very much resembles *Crabro errans*, also a ground digger belonging to the Crabronidae. None of the cap-



Nest No. 7 A curious nest having two entrances about $\frac{3}{4}$ in. apart. A to D—6 cm. D to E—3 cm. E to F—2 cm. F to G—4 cm. G to H—3 cm. A to C $3\frac{1}{2}$ cm. B to C— $2\frac{1}{2}$ cm. B to D—5 cm. Terminal cell at H contained several *Lygus pratensis*. Nest was on the slightly inclined open expanse of sand.

Nest No. 8.—Plaster filled nest which had no stored cells. *Anacrabro* was digging.

Nest No. 9.—Has one cell (terminal) at G. A to B—3 cm. B to C— $1\frac{1}{2}$ cm. C to D— $1\frac{1}{2}$ cm. D to E— $1\frac{1}{2}$ cm. E to F—3 cm. F to G— $2\frac{1}{2}$ cm. A to G in direct line 10 cm. Diam. at D 5 mm. at F 6 mm.

tured insects responded to stimulation so presumably they were stung to death. The bugs seemed to be arranged more or less accurately with the head toward the end of the cell, from four to seven being found in the fully stored chamber. The egg is laid on the thorax of the *Lygus* beginning at the neck and extending somewhat obliquely to the long diameter of the prey.

The entrance of the nest was not closed when she absented herself either during the digging or on hunting expeditions or at night.

None of the wasps were seen to make a locality study beyond a circle or two (and this in only two cases) either during excavation or before beginning to bring in prey, probably the wasps having so thoroughly familiarized themselves with the locality before nidification that no special study was required.

As is usual with digger wasps numbers of parasitic flies hovered about the nests and entered whether the wasp was present or not. In one instance the returning wasp fiercely attacked a tachina fly which was within the entrance of its nest and both rolled over and over down the bank the wasp tightly clasping the fly but whether she tried to use her sting on her opponent could not be seen in the flurry. Both kept up a furious buzzing in their progress to the foot of the bank. The wasp then released the fly and entered the nest while the tachina immediately took its station directly beside the entrance evidently none the worse for nor discouraged by the assault upon her. The wasp had not started to store the nest and was not carrying prey at the time so it may be that her failure to disable the fly by stinging was owing to the fact that her hunting instinct was still in abeyance.

NOTES AND DESCRIPTIONS OF NORTH AMERICAN PARASITIC HYMENOPTERA. VII.

By CHARLES T. BRUES.

FAMILY BETHYLIDÆ.

Cephalonomia utahensis sp. nov.

Female. Length 2mm. Black, except the tip of the antennal pedicel and the basal two joints of the tarsi which are honey yellow. Head oblong, with parallel sides, not quite twice as long as wide. Eyes oval, one-third as long as the head, exclusive of the projecting mandibles; ocelli in a very small triangle. Surface of head shining, very minutely shagreened or punctulate. Face between the antennæ with a small raised prominence with parallel sides and truncate tip, bounded on each side by a large depression. Antennæ 12-jointed, about as long as the head; scape oblongate, about two and one-half times as long as thick; pedicel as long as the first and second flagellar joints together; joints of the flagellum about quadrate, increasing in size to the sixth, then becoming slightly smaller; apical joint two times as long as the penultimate. Thorax one-half longer than the head; propleura finely longitudinally striated; pronotum faintly shagreened with sparse microscopic punctures intermixed, nearly three times as long as the mesonotum which is nearly four times as wide as long and sculptured like the pronotum; with two very faintly indicated and widely separated parapsidal furrows. Scutellum with a prominent impressed line at the base; mesopleura with a large round fovea anteriorly and a smaller one centrally. Metanotum with a delicate median carina and raised lateral margins; the entire metathorax much more coarsely punctulate than the rest of the thorax. Legs as usual, only moderately stout; entirely black, except the basal two joints of the tarsi. Wings quite distinctly infuscated; submarginal cell only one-fourth the length of the wing; ending in a prominent black stigma which is distinctly separated from the margin. Just beyond is a much smaller, secondary stigma which is continuous with the margin. Edge of the wing ciliated, more prominently so along the submarginal cell and just beyond the apex.

Described from one complete specimen and a part of another.

Type in the collections of Cornell University, cotype in the Milwaukee Public Museum.

This is a slender species conspicuous by its black legs with distinctly pale base to the tarsi. It was reared from cedar berries at Milford, Utah and sent me for identification by Mr. C. R. Crosby of Cornell University.

FAMILY PROCTOTRYPIDÆ.

Proctotrypes longiusculus sp. nov.

Male. Length 10 mm. Black; legs, except the coxæ, and abdomen except extreme base, ferruginous. Head transverse, two times as wide as thick, strongly contracted behind the eyes and sharply margined behind. Eyes bare. Clypeus broad, its anterior margins straight; broadly truncate. Front, vertex, occiput and cheeks shining, minutely punctulate. Clypeus deeply sparsely punctate and with a large fovea on each side. Mandibles dark rufous with black tips. Antennæ entirely black, slender, strongly pubescent, scape two times as long as broad at tip; flagellar joints elongate; first to tenth gradually growing shorter, the penultimate about three-fourths the length of the first. Thorax very elongate; collar finely transversely aciculate above, and



Fig. 1. *Proctotrypes longiusculus* sp. nov. Male.

faintly obliquely so on the sides below. Mesonotum shining, faintly punctulate, one and three-fourths times as long as wide. Scutellum normal, sculptured like mesonotum; methathorax very slightly arched above, as long as the mesonotum, regularly rugose reticulate, the reticulations forming quite distinct longitudinal series, but without median longitudinal carina. Plura shining, and faintly shagreened, the meso and metapleura each with a large convex, perfectly smooth area. Abdomen ferruginous, infuscated apically and black at the extreme base of the second segment and the petiole. The latter broader than long and coarsely rugose, extreme base of second segment with six short diverging carinae. Legs slender, ferruginous; coxæ, trochanters except tips, and tarsi black. Longer spur of hind tibia less than one-third the length of the metatarsus; tarsal claws simple. Wings quite distinctly infuscated; stigma, submarginal and radial veins fuscous; remaining veins distinctly indicated in pale brownish yellow; radial cell one-third as long as high and a trifle more than one-third as long as the stigma.

This species differs from *P. caudatus* by its longer antennæ, less arched metathorax and generally much more slender form.

The head is strongly contracted behind while in *caudatus* it is very faintly so.

Described from one specimen from Harrisburg, Pa., sent me by Professor H. A. Surface. I have later seen a second collected by Mr. P. R. Meyers at Enola, Pa., Oct. 3, 1908, under a stone.

FAMILY SCELIONIDÆ.

Aphanomerus americanus sp. nov.

Female. Length 1 mm. Black, the antennæ except the club and the legs except the coxæ yellow. Head slightly more than twice as wide as thick anteroposteriorly, the vertex very sharply rounded above and quite acute. Ocelli in a triangle, the lateral ones removed from the eye margin by about their own diameter. Antennæ 7-jointed, the club large and unjointed except for a trace of sutures indicating four club joints; club as long or a trifle longer than the funicle; scape stout, thickened apically, but little longer than the club; pedicel as long as the first three joints of the funicle taken together; first funicle joint longer than broad, remaining ones very short, but becoming broader; club large, ovate. Eyes bare. Surface of head shagreened. Thorax oval, pronotum visible from above, especially on the sides where it is quite broad. Mesonotum much narrowed anteriorly where it is fitted into the posteriorly excavated pronotum; with complete parapsidal furrows, its surface shagreened and thinly short whitish pubescent. Scutellum shagreened, rounded behind and provided with a marginal line. Metathorax very short, with two short, approximated strongly raised median carinae near the base, forming a sort of tooth when seen in profile. Abdomen as long as the thorax, widest near the apex of the second segment; subsessile, the first segment small, finely longitudinally fluted. Second occupying most of the surface of the abdomen, about one-fourth longer than wide and coarsely striated along the entire base; following segments very short. Legs stout, the femora strongly thickened, the tibiæ however only very slightly clavate; tarsal claws about equal. Coxæ piceous, remainder of legs yellow. Wings nearly hyaline, with a slight yellowish tinge, veinless except for a clavate pale brown submarginal vein well separated from the costal margin and reaching two-fifths the length of the wing.

Described from a large number of specimens bred by Dr. George P. Barth from the cocoons of a species of *Crabro*. Type in the collections of the Milwaukee Public Museum.

This is the first time this genus has been found in America. It was first described by Perkins from Queensland, Australia* where it is represented by a number of species parasitic on the eggs of certain leaf-hoppers. That the present species attacks the *Crabro* directly seems probable, although it may of course be a hyperparasite. That it can be an egg-parasite however, appears to be extremely unlikely.

* Bull. Hawaiian Sugar Planters' Expt. Sta., No. 1, part 6, p. 200 (1905).

FAMILY PLATYGASTERIDÆ.

Rosneta, New Genus.

Related to *Fidiobia* Ashmead and *Anopedius* Foerster. Antennæ nine-jointed, the funicle four-jointed; club three jointed; scape clavate, long and stout; pedicel large; ocelli three, in a triangle, the lateral ones almost contiguous with the eye-margin; eyes bare. Mesonotum with deep, sulcate, parapsidal furrows on its posterior half. Scutellum flat, broad and short. Abdomen nearly one-half longer than the head and thorax together, narrowly sessile; second segment very long; tip of abdomen broadly rounded. Wings scarcely pubescent, not ciliate on the margins.

Type: *R. tritici* sp. nov.

Rosneta tritici sp. nov.

Female. Length 0.6 mm. Black, the legs including coxæ and antennæ except club, rather light yellow. Head twice as wide as thick, its occipital margins slightly concave; surface punctulate; ocelli in a broad triangle, the lateral ones removed by less than their own diameter from the eye-margins. Antennæ 9-jointed, short and stout, the scape two-thirds as long as all the following joints together, strongly incrassated; pedicel large, stouter and fully twice as long as the first flagellar joint, which is slightly longer than wide; second to fourth flagellar joints very small, quadrate, about as wide as the first; following three forming a very large stout oval club, the first two joints of which are quadrate and the apical one a trifle longer and conic. Eyes bare, Prothorax and mesonotum roughly punctulate, the scutellum smooth and shining; parapsidal furrows indicated only on the posterior one-half of the mesonotum, but very deep and broad, in the form of deep sulci which have a polished smooth surface. Scutellum broad and short, fully twice as broad as long, at its extreme sides with a longitudinal groove which is farther from the median line than the parapsidal furrow. Metanotum very short and sharply truncate behind; above with two widely separated median longitudinal carinæ just outside the postscutellum, and with the lateral margins less distinctly carinated. Abdomen oval, rounded at the tip, almost sessile at the base; first segment short, second long, fully three times as long as the following together which decrease rapidly in length to the tip. Legs stout, the femora strongly and the tibiæ more weakly clavate. Wings veinless, hyaline, not ciliate and only very weakly pubescent on the surface.

Described from six specimens reared from wheat stubble collected at Middleport, N. Y. and sent me by Mr. C. R. Crosby of Cornell University.

Anopedius error Fitch has also been reared from *Diplosis tritici* affecting wheat, but I do not believe it could possibly be this species, even though Fitch's original account is rather too indefinite to place his species very accurately.

FAMILY EURYTOMIDÆ.

Bephratoides New Genus.

Related to *Bephrata* Cameron, but differing in the form of the anterior femora which are greatly swollen, as large as the posterior ones, grooved beneath for the reception of the tibiae and denticulate below for their entire length. Head and thorax coarsely punctate; metanotum short, abruptly declivous, with a deep median sulcus; pronotum as long as the scutellum and slightly contracted posteriorly. Antennæ inserted above the middle of the face, 11-jointed, with one ring joint; joints of flagellum long, cylindrical, the first two-thirds the length of the scape. Abdomen oval as long as the thorax, greatly compressed, in side view higher than the thorax, but seen from above it is only about one-third as broad as the pronotum; eighth segment reduced into a small stylus or aculeus. Wings with marginal, stigmal and postmarginal veins long.

Type species.—*B. maculatus*, sp. nov.

Bephratoides maculatus sp. nov.

Length 5 mm. Black, marked with yellow; legs mostly yellow: head transverse, a little more than two times as broad as thick and somewhat broader than high. Occiput deeply arcuately emarginate between the eyes, the emargination extending halfway to the front of the head; ocelli in a curved line, close to the emargination of the occiput, equidistant from each other and the eye-margin. Antennæ filiform, 11-jointed, black except the basal three-fourths of the scape and the tip of the pedicel; first flagellar joint three times as long as thick, second two-thirds as long as the first, following growing shorter gradually to the club-joints which decrease rapidly. Eyes ovate, nearly circular, bare; but little longer than the cheeks; front above the antennæ with a deep groove for the reception of the antennal scapes. Face nearly flat, coarsely confluent punctate and sparsely clothed with stiff white hairs. Malar groove present. Head behind with raised margin which however does not extend to the occiput. Mandibles stout, obliquely truncate at the tip, with two faintly indicated teeth at the apex. Palpi slender, short; front and vertex sculptured like the face; occiput smooth or faintly vertically aciculated. Prothorax two-thirds as wide as the head, one-half broader than long and quite distinctly narrowed posteriorly, its surface coarsely punctured, most roughly so along the median line, the punctures growing smaller laterally and on the pleuræ, near the coxæ giving place to fine transverse aciculations. Mesonotum evenly punctate, its punctures the size of those along the sides of the pronotum, a little shorter than the pronotum and one-fourth broader than the pronotum behind where it is much widened. Scutellum and axillæ punctate like the

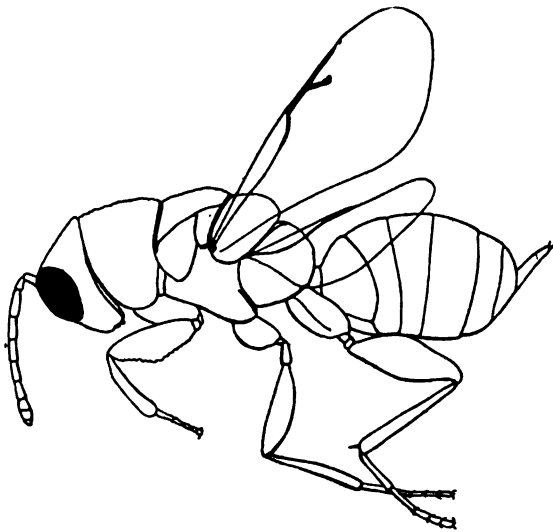


Fig. 2. *Bephratoides maculatus* sp. nov. Female.

mesonotum, the scutellum more coarsely so, rounded behind and as long as the pronotum. Metathorax punctate with a deep smooth longitudinal sulcus. Abdomen oval, very sharp above, as long as the thorax. First segment very small, following four segments of nearly equal length, sixth and seventh much shorter, the latter punctulate, eight forming an aculeus about as long as one of the basal segments. Legs stout, especially the anterior and posterior femora; anterior femora with an obtuse lobe below toward the apex and denticulate for its entire length; posterior femora as large as the anterior ones and faintly denticulate below medially; posterior tibia with two short spurs. Wings hyaline, veins yellow; marginal vein one-fourth the length of the submarginal; stigmal one-half as long as the marginal, knobbed; postmarginal one-fourth longer than the marginal. Head black on the vertex and occiput, elsewhere yellow; prothorax yellow except the dorsum and a fine marginal line posteriorly on the pleurae; mesothorax except tegulae, and metathorax entirely black; abdomen yellow, with the extreme base, a dorsal line to near the tip, lower basal one-half and an irregular subapical spot black, aculeus black. Legs yellow, all femora and tibiae with abbreviated black lines exteriorly.

One specimen, Brownsville, Texas, sent me by Mr. Charles Schaeffer. This is a most interesting insect, of undoubted tropical affinities and I believe generically distinct from *Bephrata* Cameron.

FAMILY PTEROMALIDÆ.

Asaphes rufipes sp. nov.

Female. Length 1.4—1.6 mm. Greenish aeneous black with the legs except coxæ reddish or brownish yellow. Head seen from above a little wider than the thorax at the base of the wings; about twice as wide as thick. Occiput concave, but not strongly excavated, its edge finely margined. Vertex finely punctulate. Eyes bare; ocelli in a triangle the lateral ones as far from the median one as from the eye margin. Front strongly excavated medially below the ocelli, its surface shining and sparsely hairy. Cheeks about two-thirds as long as the eye-height; mandibles fuscous. Malar furrow wanting. Antennæ 13-jointed, gradually clavate; scape two-fifths the length of the flagellum, rather slender and nearly straight; pedicel one-third as long as the scape, obovate; two ring joints; funicle joints increasing a very little in length, but considerably in width, the first a trifle longer than thick and the last fully one-half wider than long; joints of club consolidated, together as long as the three preceding taken together and little broader than the last funicular joint. Pronotum long, nearly as long as the mesonotum, considerably narrowed anteriorly. Mesonotum with deep, very distinct, strongly convergent parapsidal furrows, its surface and that of the pronotum shagreened. Axillæ extending in as far as the parapsidal furrows. Scutellum shagreened on its basal half, posteriorly smooth and polished; at the apical third with a cross furrow made by confluent punctures. Metathorax microscopically rugose above; below on the pleuræ smooth; the pleuræ above with a longitudinal elevation which is sparsely clothed with long fine white hairs. Petiole of abdomen coarsely fluted and finely rugulose on the surface, shorter than the second segment and distinctly longer than wide. Body of abdomen triangular in lateral view, fully three-fourths as high as it is long on the dorsum; second and third segments of equal length; fourth one-half as long and the fifth only one-half as long as the fourth; apex of abdomen produced as a very short stylus. Wings hyaline, veins pale brown, the marginal vein five or six times as long as thick; stigmal about one-third longer, slender, knobbed at the tip postmarginal about one-fourth longer than the marginal. Legs slender, pale reddish brown, the posterior femora somewhat infuscated.

Described from four specimens bred from a species of *Aphis* (probably *A. atriplicis* Linn.) on *Chenopodium album* at Forest Hills, Mass., October 30, 1908 by Mr. Paul Hayhurst of the Bussey Institution. Type in the collections of the Public Museum of the City of Milwaukee.

FAMILY EULOPHIDÆ.

Chrysocharis aeneus sp. nov.

Female. Length 1.5 mm. Shining greenish black, the antennal scape and pedicel and most of the legs except sometimes the anterior femora, yellow. Head very flat, attached to the thorax near its upper side; viewed from the front it is one-third higher than broad. Front with a deep longitudinal depression above the insertion of the antennæ which is however, markedly narrowed above the middle of the front. Antennæ inserted close to the clypeus; 9-jointed, with one ring-joint; scape stout, reaching one-half way from its insertion to the vertex; pedicel one-third as long as the scape, contracted basally; ring-joint so small as to be scarcely discernible; funicle joints three, about equal, nearly quadrate or slightly moniliform when seen in side view; seen in another plane they grow thicker apically the third being nearly twice as broad as long and as wide as the first joint of the ovate club; second club-joint much narrowed apically, third extremely small, pointed and appearing as an appendage of the second. Eyes small, oval, bare; separated by three-fourths their length from the base of the mandibles. Thorax elongate, smooth; pronotum as long as wide at the base, anteriorly narrowed, mesonotum with sharply defined furrows which converge posteriorly where they are very nearly continuous with two parallel grooves on the scutellum, metanotum with a delicate median carina which forks at the extreme tip, curving outward and forward to form a lateral divergent carina which terminates basally near the lateral margin of the scutellum. Abdomen sessile, as long or but little longer than the thorax and slightly flattened; first five segments of about equal length, slightly increasing in width to the fourth; apex rounded, ovipositor not projecting. Legs slender, yellow, except the coxæ which are black, and the anterior femora which are piceous, except at the tip; posterior tibiæ with a single spur about three-fourths the length of the first tarsal joint. Tarsi four jointed. Wings hyaline, marginal vein about one-fourth longer than the submarginal; stigmal clavate, one-fourth the length of the marginal; postmarginal faintly indicated but extending for a considerable distance.

Described from a large number of females bred by Dr. George F. Barth at Milwaukee, Wisconsin, from the cocoon of a species of *Crabro*.

***Nesomyia cimbicis* sp. nov.**

Female. Length 1.25—1.5 mm. Metallic green, head more bluish; spots on the axillae and the occiput below, and the face, more or less cupreous. Head transverse, about three times as long as thick. Face above the insertion of the antennæ finely rugose punctate, above on the vertex shagreened. Ocelli large, in a small triangle. Eyes pubescent. Vertex and front with a few stiff white erect hairs. Mandibles small, acute, bidentate; cheeks short, about one-eighth the eye-height; malar furrow present. Antennæ 9-jointed; scape, pedicel, one ring joint, three funicle joints and a three jointed club, the club with only two distinct joints, the apical one being very small and slender, styluslike; funicle joints each about two times as wide as long; first club joint slightly shorter and thicker; second as long as the first, tapering; all the antennal joints rather hairy; mesonotum and scutellum scaly punctate, the parapsidal furrows indicated posteriorly as depressions, obsolete anteriorly; scutellum nearly as long as the mesonotum, acutely rounded behind, with a long bristle on each side near the middle; postscutellum very short, very broadly angled medially at the tip. Metanotum very short, finely rugulose. Abdomen sessile, almost orbicular, with obtusely pointed apex; segment two the longest; three to six shorter, nearly equal, the last small, triangular. Wings hyaline, pubescent, with short marginal cilia; submarginal vein one-half as long as the pale marginal; stigmal short, clavate; postmarginal nearly two times as long as the marginal. Legs slender, pale yellow, almost white, their coxae æneous black except at the extreme apices.

Three specimens, bred from eggs of *Cimbex americana* Leach, collected at Milwaukee, Wisconsin. Type in the Milwaukee Public Museum. They were brought to me for identification by Mr. Henry Severin of the University of Ohio.

FAMILY BRACONIDÆ.***Cosmophorus hypothememi* sp. nov.**

Female. Length 1 mm. Piceous black; face and first three joints of antennæ yellowish brown; legs fuscous, trochanters, knees, base and tips of tibiæ and base of tarsi yellowish or testaceous. Head one and three-fourths times as wide as thick, much excavated on the occiput. Front with a deep excavation above the insertion of the antennæ, the median ocellus placed on its upper margin. Antennæ inserted on a projecting ledge which bears two approximated teeth at the insertion of the antennæ. Antennæ 14-jointed, filiform, the scape stout and

short, almost globose; first joint of flagellum longer, but much more slender than the pedicel; second joint subequal, stouter; following gradually becoming shorter to the tip, all however more than twice as long as thick. Face below the antennæ rugose; clypeus short and broad, punctate. Mandibles broad, leaving a broad opening when closed. Eyes small, oval; sparsely pubescent. Surface of head smooth and highly polished. Thorax short, mesonotum without furrows, smooth and shining, at the base of the scutellum with a transverse groove, scutellum rather long, rounded off on the sides and behind. Metanotum finely rugose, incompletely areolated; two very closely approximated median longitudinal carinæ, a lateral carina on each side and a transverse V-shaped one across the upper edge of the posterior slope. Pleuræ irregularly rugose-punctate. Abdomen petiolate, the petiole longer than the metathorax and equalling the remainder of the abdomen, its surface above finely longitudinally rugose, two and one-half times as long as broad at tip and but slightly widened behind. Body of abdomen globose, the second segment occupying most of its surface. Ovipositor almost as long as the abdomen. Wings hyaline, stigma and nervures pale brownish piceous, the extreme base of the stigma pale. Stigma large, ovate nearly as long as the radial cell; first discoidal and first cubital cells confluent; second discoidal cell open.

One specimen, bred by Professor H. A. Surface from a species of *Hypothenemus*, thought by Dr. A. D. Hopkins to be undescribed.

Ashmead has already described one American representative of this genus, differing from the present species by its much larger size, different antennæ, etc.

Public Museum, Milwaukee, Wis.

March 1, 1909.

A SUMMER'S INSECT COLLECTING.

By RICHARD A. MUTTKOWSKI.

To entomologists in Milwaukee County the collecting season of 1908 will always be memorable; not so much for the results of their labors, as for the various factors that worked to introduce a season replete with surprises. Foremost was the belated beginning. A winter full of severe storms, with frosts extending far into May, precipitated a remarkably short spring. Trees that had begun to bud during April, but had ceased to develop in the following cold weather, now burst into full bloom. Fauna and flora, retarded so long, renewed their life.

The results of this belated spring were immediately manifest: botanists noted a general jumble in the early flower-months, May, June and July. May flowers blossomed together with those of June and early July. Thus Early Meadow Rue flowered simultaneously with Tall Meadow Rue. Goldenrod made its appearance several weeks earlier than usual.

The early appearance of some food-plants may have hastened that of the insects. In support I may cite a difference of several weeks in the dates of attaining maturity among the Lepidoptera, Neuroptera, and Hymenoptera. Dr. Graenicher reports a seasonal disturbance among bees also, the May and July types appearing together at the end of June. Among Neuroptera this disturbance was less marked, though perceptible; thus *Chauliodes pectinicornis* and *C. rastricornis* appeared in late June.

The Lepidoptera, however, show a number of striking accelerations, among them that of a whole group, the *Catocalinae*, which appeared a full month earlier than in previous years. With these accelerations came other results, specially noticeable in the *Catocalæ*, such as increase or decrease of size, intensification of colors, widening or narrowing of bands. As instances of increased size *Archips rosaceana* and other *Tortricidæ* may be mentioned. *Calpe canadensis* (in part), *Apatela brumosa*, *Catocala lucinda*, show the opposite condition. *Catocala cara*, *ilia*, *con-cumbens*, *lucinda*, *cerogama*, showed a general darkening of the fore wings and a greater brilliance of the colored bands of the hind wings. The latter effect was especially prominent in *C. cara*, while all captured specimens of *C. cerogama* show a distinct de-

crease in the width of the yellow band of the hind wing. Other species again show a distinct brightening of their markings. Of a specimen of *Apatela hasta* Dr. J. B. Smith writes: "It has the markings of *hasta*, but is brighter than any specimen I have ever seen." At another place he writes: "It is a puzzle and I am almost inclined to suspect a foreigner.——it is unlike any specimen in my collection". Of *Ap. brumosa* he says: "A very small example for a female and yet it resembles nothing else so much".

Collecting in general, as will be seen by the list, was prolific in numbers of species obtained, yet not in numbers of specimens; but prolific only during part of the summer. Climatic conditions served to make the latter part of summer a void as to collection of interesting Lepidoptera. The last rainfall of July 15th marked the beginning of a drouth and a season of forest fires, cold and general inclemency, such as Wisconsin has rarely seen. After the 1st of August little of value was captured. Smoke hung over the woods in a heavy pall during the two following months, the drouth dried up the creeks and various swamps and ponds, parching the ground till it split open in inch-wide fissures. The flower-season was thus quickly ended.

Not until the first week of October did the relieving rains fall and extinguish the fires in upper Wisconsin and clear the air of the dense smoke. A few successful nights marked October. But the latter part of the month again brought on the forest fires, this time upon Milwaukee. West Allis and its surrounding forests, including Johnson's Woods, were visited by the fires, the whole underbrush of the latter swept away; with what results the coming season will show.

Collections were obtained chiefly from Johnson's Woods and Layton Park by the author, and from the Milwaukee River by Mr. Fernekes. North and East Milwaukee, Whitefish Bay, Wauwatosa, and the County Line were visited intermittently.

Note. (F), (J), and (B) after the names of species refer to Mr. V. Fernekes, Mr. H. Bower, and Mr. John Jacobs, respectively; and species so marked should be credited to these collectors.

ODONATA.

Little time was devoted to the collection of insects of this group. The few records obtained result from desultory captures during the collection of Lepidoptera. However, a few interesting specimens were received from Dr. Was of Oostburg, Sheboygan Co. As the collections of the Museum already contain species of that region collected by Mr. Henry L. Ward, but at a much later date than the 1908 species, Dr. Was' donations serve to complete the seasonal series from Eastern Wisconsin, Transitional region.

Calopteryx maculata Beauv. Milwaukee, June 13. On shady river banks, in high grass. Also from Oostburg, Wis., June 13—July 16.

Calopteryx æquabilis Say. Loc. et die citato.

Hetærina americana Say. Loc. et die cit.

Lestes eurinus Say. Milwaukee, June 13. On stones in river, near rapids Oostburg, July 9.

Lestes unguiculatus Hagen. June 13. Milwaukee River, in high grass on bank. Johnson's woods, July 26, in marsh. Oostburg, July 20.

Lestes uncatus Kirby. Milwaukee, loc. et dieb. cit. Oostburg, July 8.

Lestes disjunctus Selys, Oostburg, June 11. From marsh.

Lestes rectangularis Say. Milwaukee, Aug. 3, Milwaukee River. High grass on banks.

Ischnura verticalis Say. Milwaukee River, June 13. In high grass in sunny spots.

Enallagma hageni Walsh. Milwaukee, June 13. High grass on river bank. Oostburg, July 8.

Enallagma calverti Morse. Oostburg, July 26.

Enallagma exsulans Hagen. Milwaukee River, June 13. High grass on river bank.

Gomphus fraternus Say. Milwaukee River, June 13. Open sunny and shaded places on river bank.

Anax junius Drury. Milwaukee. July and August. On streets, in building near river, and in woods.

Æschna tuberculifera E. Walker. July 16. Oostburg. The Museum collection of *Æschnæ* was sent to Prof. E. M. Walker of Toronto, who is at present monographing this genus. The data for the present and following species are given by Prof. Walker in a letter.

Æschna canadensis E. Walker. Milwaukee, June 14, from woods in East Milwaukee and Wauwatosa. Oostburg, July 4, 1908.

Æschna verticalis Hagen. Milwaukee, in woods, June 14.

Æschna constricta Say. August.

Æschna umbrosa E. Walker.

Epiæschna heros Fabr. Oostburg, June 16.

Epicordulia princeps Hagen. Oostburg, June 15. The first record from Wisconsin.

Sympetrum vicinum Hagen. East Milwaukee, July 24. In woods near marsh.

Sympetrum obtrusum Hagen. July 24—Sept. in marshy woods. This species was very abundant. Mr. Burrill reported a night in mid-August on which the species flew in such large swarms in the vicinity of Lake Park and Wonderland that it was impossible for people to remain outside.

Sympetrum rubicundulum Say. Johnson's woods, July 26, in marsh.

Sympetrum sp. A very interesting male obtained from Fox Lake,

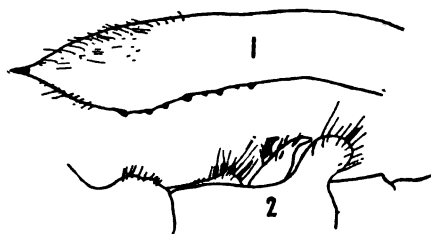


Fig. 1. *Sympetrum* sp. Superior appendage and genitalia.

Douglas Co., by Mr. H. L. Ward. Apparently it is *S. costiferum*, on comparison of the genitalia, which are nearly identical. It differs, however, in the unusual number of eight denticles inferiorly of the superior appendages, while *S. costiferum* is known to have four or five. The specimen is still in teneral stage, but bears unmistakable indications of the markings of a fully developed specimen. The markings are identical with those of *S. costiferum*, save that the tarsi are entirely black, and not only ringed apically on the joints.

Leucorhinia intacta Hagen. Milwaukee, July and August, on roadsides, in fields. Oostburg, July 8. A female from Oostburg presents an abnormality by having rather more than the usually flavescent area at the base of the wings fuscous (blackish) halfway to the nodus.

Pachydiplax longipennis Burm. July 10, Oostburg.

Libellula quadrimaculata Linn. Oostburg, July 10. Milwaukee, June to August, abundant in woods.

Libellula semifasciata Burm. Oostburg June 16.

Libellula pulchella Drury. Oostburg and Milwaukee, June to Aug. In woods and fields.

Libellula basalis Say. Oostburg, June 26.

Plathemis lydia Drury. Oostburg, June 9.

Pantala flavescens Fabr. Sunny river bank, Milwaukee, Sept. 16.

—————:—————

Other Neuroptera captured by the author are:

Chauliodes pectinicornis Linn. et **rastricornis** Ramb., both species on sugar the latter part of June.

Chrysopa rufilabris Burm, **oculata** Say, et **nigricornis** Burm. On sugar in marshy woods.

Panorpa rufescens Ramb. June. Johnson's woods.

Bittacus strigosus Hagen. County Line, July 9.

Phryganea vestita Walker. On oak in Wauwatosa, West Allis and East Milwaukee, June and July.

Neuronia postica Walker. On oak and sugar in marshy woods. Johnson's woods, Wauwatosa, June to August.

Limnephilus indivisus Walker. On sugar in marshy woods. Johnson's woods, June to September.

Colpotaulius medialis Banks. On sugar in marshy woods. Johnson's woods July 10.

Hydropsyche scalaris Hagen, **Kansensis** Banks, **morosa** Banks. **analisis** Banks. Milwaukee, June 5—Aug. 15, at light near Milwaukee river.

Limnephilus submonilifer Walker.

Hexagenia bilineata Say.

Ephemera simulans Walk.

Cænis hilaris Hagen.

Cleon vicina Hagen.

Siphonurus aridus Say.

Heptagenia flaveola Pict. (?)

Heptagenia terminata Walsh.

Correction: Among the material collected by the Museum Expedition in Vilas Co., Wis., June 24-30, 1907, I found upon comparison one male *Tetragoneuria spinosa* Hagen. This record, added to the three other species of *Tetragoneuria* known from Wisconsin, completes the series of Northern species of *Tetragoneuria* for the state. *T. spinosa* is known from few localities and these chiefly Eastern. The occurrence of this species both in the White Mts. of N. Hampshire and in Northern Wisconsin is but another instance of the noted resemblance of the fauna of these two widely separate localities. (Bull. Wis. Nat. Hist. Soc. 6, pp. 60, 101, 1908.)

Public Museum, Milwaukee, Wis.

March 1, 1909.

A NEW FOSSIL GRASS FROM THE MIOCENE OF FLORISSANT, COLORADO.

BY CHARLES T. AND BEIRNE B. BRUES.

The occurrence of fossil Gramineæ in the Miocene shales of Florissant was first noted by Cockerell* who described *Stipa laminarum* from these deposits.

In the present note we have the pleasure of describing a second species, referable to the genus *Melica*, also collected by Professor T. D. A. Cockerell and very kindly loaned to us by him for study. Through the efforts of Lesquereux, Cockerell and others the fossil flora of the wonderfully rich deposits of this region have been quite thoroughly worked out and many species have been described, but so far only two species of grasses have been brought to light.

Like *Stipa*, the genus to which the new form belongs is at the present time widely distributed throughout temperate and subtropical regions where it is represented by a considerable number of species.

Melica primæva sp. nov.

The specimen shows a detached pair of second spikelet viewed from the inner, or side nearest the rachis. The spikelet which is

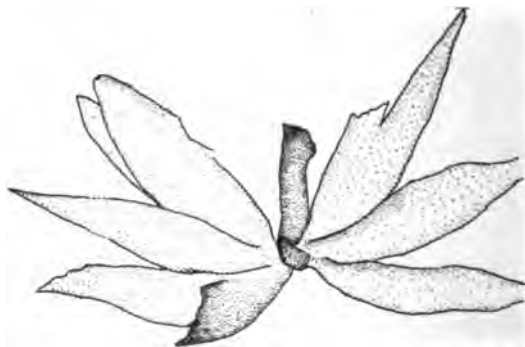


Fig. 1. *Melica primæva* sp. nov. Shaded portions indicate lower laminae of the shale.

best preserved is about 12 millimeters long and shows five glumes; the lower of these, presumably one of the empty glumes is visible only at the base, its apical portion extending under the shale be-

* Bull. Amer. Mus. Nat. His., Vol. 24, p. 79 (1906).

neath the lowest flowering glume. The latter is not well preserved at the tip, but the second is visible for its entire length. It is 10 mm. long and about 2 mm. wide, broadly lanceolate in outline, with acutely pointed but unawned apex. Between the second and third flowering glumes can be seen the apex of the second empty glume. The spikelet thus appears to be three flowered, which also appears to be true of the second one, which shows three flowering glumes in a position symmetrical to those of the first and bears an empty glume partly hidden in the shale in almost the same position as the upper empty glume of the first spikelet. The lower empty glume of this spikelet probably lies beneath the first flowering glume in the shale.

Described from one specimen collected at Florissant, Colorado by Prof. T. D. A. Cockerell in the Miocene shales at station 14.

The present species appears to belong quite properly to *Melica* with which it agrees in all essential particulars. The second insertion of the two spikelets as shown in the type, their large size and the form of the glumes, and the apparently very short joints of the rachilla seem to determine its location here with but little doubt. A superficially similar arrangement of the spikelets occurs in certain *Hordeae*, but other characters exclude it from a place in this tribe.

THE GENERIC NAME ROOSEVELTIA.

I find that *Rooseveltia* proposed by me for a genus of *Attidæ* from Borneo, Trans. Wisconsin Acad. Sciences, Arts and Letters, Vol. XV, pt. II, p. 164 (1907) is preoccupied in Jordan and Seale's Fishes of Samoa, Dept. Comm. Lab. Bur. Fish., No. 25 (1906). I propose in its place *Ogdenia* after Dr. H. V. Ogden of Milwaukee.

GEO. W. PECKHAM.

LIST OF MEMBERS OF THE WISCONSIN NATURAL HISTORY SOCIETY.

ACTIVE MEMBERS.

B. Frank Adler	17 Prospect Ave.
Samuel D. Adler	173 Prospect Ave.
Dr. A. W. Akerly	National Soldiers' Home.
Clarence J. Allen	555 Juneau Place.
William W. Allis.....	526 Marshall St.
Hugo Altschwager	118 Harmon St.
Rev. Thomas Edward Barr.....	Hotel Pfister.
Dr. Edwin W. Bartlett	422 Jefferson St.
Dr. George P. Barth	312 Goldsmith Bldg.
Dr. J. S. Batchelor	Masonic Bldg.
Dr. William A. Batcheler	1109 Kinnickinnic Ave.
Miss Anna M. Berger	863 Summit Ave.
Mrs. A. Bernhardt.....	1300 Grand Ave.
Val. Blatz	236 Prospect Ave.
G. Fred Bossert	719 Franklin St.
Gottlob Bossert	719 Franklin St.
Mrs. Sarah M. Boyd	495 Juneau Place.
Dr. G. V. I. Brown	349 Prospect Ave.
Charles T. Brues	Public Museum.
Dr. A. H. Brundage	2404 State St.
Louis W. Bunde	289 Lyon St.
Dr. Arthur J. Burgess	1102 Grand Ave.
Alfred C. Burrill	Public Museum.
George Burroughs	463 Van Buren St.
Charles C. Carpenter	841 Cass St.
Mrs. Charles Catlin	343 Farwell Ave.
N. A. Christensen	499 Terrace Ave.
Dr. Oscar Chrysler	National Soldiers' Home.
Herbert Clowes	Public Museum.
Edgar W. Coleman	Herold Bldg.
George W. Colles	Alhambra Bldg.
Dr. A. Ivans Comfort	National Soldiers' Home.
Dr. Ernest Copeland	141 Wisconsin St.
L. F. Crosby	2426 Wells St.
Dr. P. H. Dernehl.....	942 Second St.

Dr. Richard Dewey	Wauwatosa, Wis.
Charles Doerflinger	254 Ninth St.
Rev. Frederick Edwards	184 24th St.
B. H. Eiring	2918 Cedar St.
Miss Flora Elmer	637 Stowell Ave.
Eltinge Elmore	603 Prospect Ave.
Albert C. Elser	436 East Water St.
John Elser	427 Cass St.
Clarence R. Falk	419 Terrace Ave.
George B. Ferry	419 Broadway.
Dr. Filip A. Forsbeck	646 Cass St.
William Finger	297 12th St.
Adolph Finkler	612 Commerce St.
Charles S. Forsyth	354 Juneau Ave.
Dr. Louis F. Frank	2300 Grand Ave.
Ralph M. Friend	2630 Cedar St.
Dr. E. B. Fuller	422 Camp Bldg.
Mrs. Albert F. Gallun	456 La Fayette Place.
Emma Gardener	676 Wilson St.
Dr. Walter Goldschmidt	309 Caswell Block.
Dr. S. Graenicher	551 Seventh St.
William J. Grant	Grant Marble Co.
Max Griebisch	German-English Academy.
Dr. Rudolph C. Gruettner	271 22nd Ave.
Miss Della S. Guile	654 Jefferson St.
Herman F. Haessler	633 11th St.
O. J. Habegger	438 East Water St.
Paul Hammersmith	116 Michigan St.
William Hinrichs	605 Colby-Abbott Bldg.
Richard W. Houghton	571 Juneau Place.
Alexander R. Houston	201 Martin St.
Nelson P. Hulst	300 Knapp St.
Edward M. Hyzer	531 Marshall St.
J. F. W. Inbusch	174 Martin St.
James G. Jenkins	284 Knapp St.
Philipp Jung	623 Second St.
A. C. Katze-Miller	Public Museum.
Dr. Gustav J. Kaumheimer	786 Third St.
F. A. W. Kieckhefer	2605 Grand Ave.
Charles L. Kiewert	9 Waverly Place.
William C. Klann	2816 Chestnut St.
Alvin P. Klettsch	Republican House.
Charles A. Koeffler	909 Pabst Bldg.

H. A. Koch	Republican House.
Rudolph M. Koss	87 West Water St.
Julius Lando	419 East Water St.
Dr. C. F. Lange	900 First St.
Dr. A. J. M. Lasché.....	2809 Vine St.
Adolph F. Laue	1111 Sycamore St.
August S. Lindemann	2912 Highland Blvd.
Louis Lotz	615 Galena St.
William MacLaren	414 Irving Place.
Charles L. Mann	124 Farwell Ave.
Robert W. Martin, Jr.	3100 Wells St.
George P. Mayer	3015 Grand Ave.
Louis Mayer	915 Bartlett Ave.
Dr. John J. McGovern	2119 Prairie St.
Dr. Patrick H. McGovern	2036 Grand Ave.
F. Meinecke	623 Milwaukee St.
Benjamin J. Miller, Jr.	102 Wisconsin St.
George P. Miller.....	316 Juneau Ave.
I. N. Mitchell	State Normal School.
Charles E. Monroe	800 Pabst Bldg.
A. Monsted	507 Pabst Bldg.
Richard A. Muttkowski	Public Museum.
Robert Nunnemacher	Railway Exchange Bldg.
Dr. H. V. Ogden	Goldsmith Bldg.
Gustave Pabst	917 Chestnut St.
Dr. George W. Peckham	Public Library.
J. M. Pereles	529 Astor St.
T. J. Pereles	535 Astor St.
Richard M. Philipp	596 Jackson St.
Frederick L. Pierce	176 Farwell Ave.
William W. Plankinton	135 Grand Ave.
J. M. W. Pratt	313 Summit Ave.
Albert C. Puelicher	137 Wisconsin St.
Gustav Reuss	668 Sixth St.
Rudolph G. Richter	489 Terrace Ave.
Paul C. Rohde	Public Museum.
Mrs. E. Ruemmelin	736 Weil St.
Howland Russel	106 Mason St.
Dr. Joseph Schneider	Pabst Theater Bldg.
B. S. Scheftels	3224 Chestnut St.
Miss Helen Sherman	176 Mason St.
Dr. Lewis Sherman	448 Jackson St.
George Shrosbree	Public Museum.

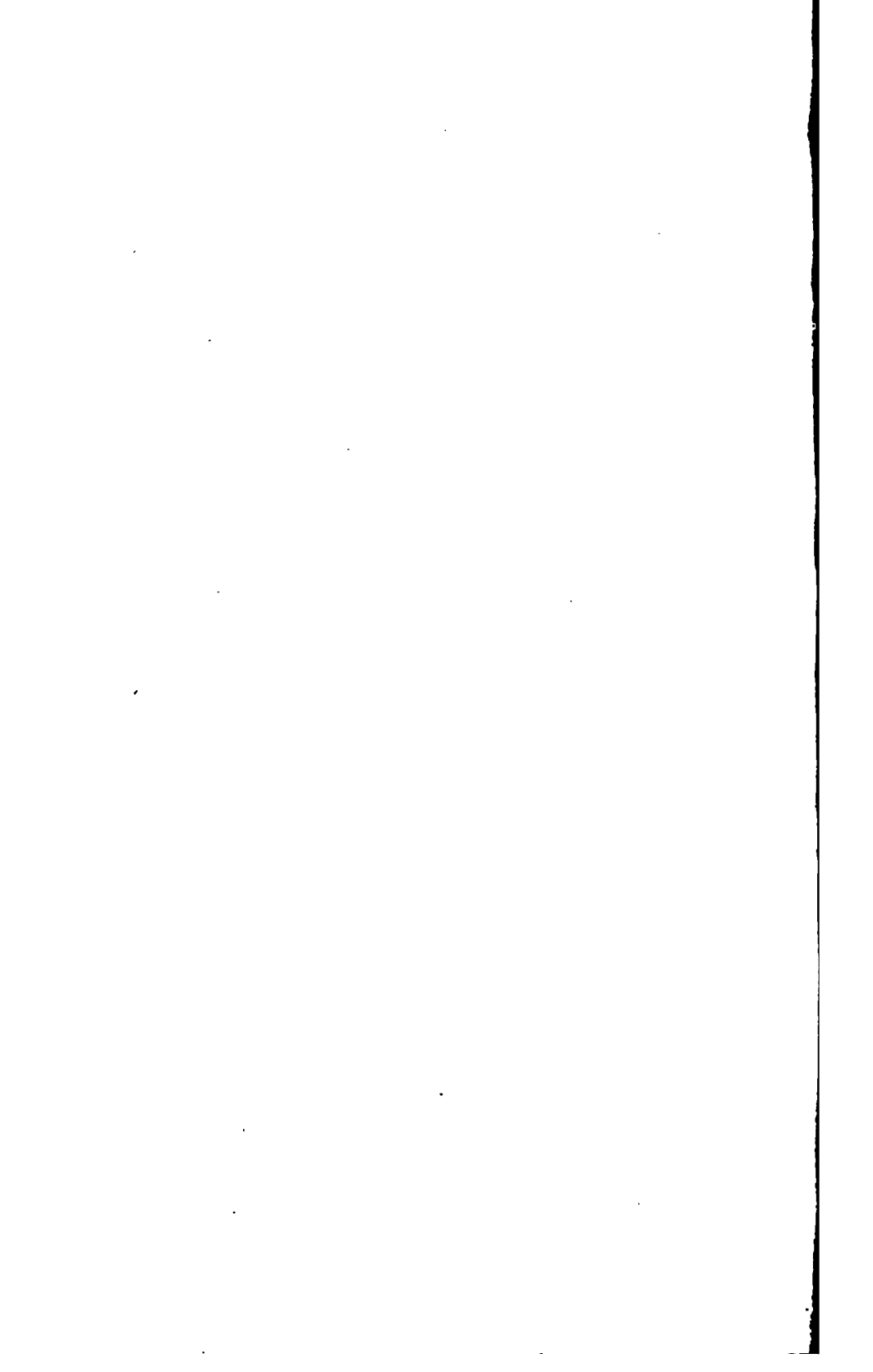
J. W. Skinner	34 New Insurance Bldg.
Richard E. W. Sommer	1302 Wells St.
Mrs. Mary Steinmeyer.....	2427 Grand Ave.
Walter Stern	525 Astor St.
Gardner P. Stickney	Pabst Bldg.
Edgar E. Teller	3321 Sycamore St.
Carl Thal	Public Museum.
William George Thwaits	405 Iron Block.
Rev. Judson Titsworth	216 Martin St.
Charles Trieschmann	430 Hanover St.
Gustav J. A. Trostel	555 Terrace Ave.
John H. Tweedy	508 Marshall St.
August Uihlein	332 Galena St.
Joseph E. Uihlein	930 Lake Drive.
William H. Vogel	213 14th St.
Fred Vogel, Jr.	538 Cass St.
Henry L. Ward	Public Museum.
Charles B. Weil	286 Knapp St.
Dr. Robert G. Washburn.....	1240 Wells Bldg.
George A West	1215 Railway Exchange Bldg.
Charlie B. Whitnall	026 Locust St.
Gen. Fred C. Winkler	131 11th St.
A. J. Wright	201 Wisconsin St.
Charles H. Yunker	2520 Cedar St.

CORRESPONDING MEMBERS.

Dr. E. R. Buckley	Flat River, Mo.
W. P. Clark	Milton, Wis.
Dr. John J. Davis	Racine, Wis.
N. Hollister	Biological Survey, Washington, D. C.
H. H. T. Jackson	Milton, Wis.
Miss Clara J. Jones	West Bend, Wis.
Rudolph Kuehne	825 N. Market St., Sheboygan, Wis.
Dr. Geo. W. C. Meyer	Oconomowoc, Wis.
Dr. D. McL. Miller	Oconomowoc, Wis.
Rev. E. C. Mitchell	534 Summit Ave., St. Paul, Minn.
H. C. Oberhalser.....	Biological Survey, Washington, D. C.
Henry L. Skavlem	Janesville, Wis.
Dr. Charles E. Slocum	Defiance, Ohio.

ACTUAL DATE OF PUBLICATION, APRIL 20, 1909.





RECEIVED

MAR 8 1907

L. Soc. 120. WS. 16

~~LEABODY MUSEUM.~~

Vol. 5 (New Series)

JANUARY, 1907

No. 1

4

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY

EDITED BY THE SECRETARY



CONTENTS:

Proceedings.

The Origin of Species - - - - -	Charles Otis Whitman
Wisconsin Flowers and Their Pollination - - -	S. Graenicher
New Chalcid-Flies From Cape Colony - - -	Charles T. Brues
Notes and Descriptions of North American Parasitic Hymenoptera—III - - -	Charles T. Brues
A Weasel New to Wisconsin's Fauna - - -	Henry L. Ward

MILWAUKEE, WISCONSIN.
THE EDW. KEOGH PRESS

s

The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6, 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Brues, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....551 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, Geo. W. Peckham,
Chas. E. Monroe.

REGULAR MEETINGS.

These are all held on the last Thursday of each month, except July and August, in the lecture room in the Museum-Library Building. Milwaukee.

PUBLICATION.

The "Bulletin of the Wisconsin Natural History Society."

MEMBERSHIP DUES.

City Members, \$3.00 per annum; Non-resident Members, \$2.00 per annum; Life Members, one payment of fifty dollars.

Orders and remittances should be addressed to the General Secretary, Public Museum, Milwaukee, Wis.

1871 10 cents.

Case 15-

Shelf

Prus. of the



LIBRARY

OF THE

PEABODY MUSEUM OF AMERICAN
ARCHÆOLOGY AND ETHNOLOGY.

EXCHANGE WITH

Wisconsin

Natural History Society
Received March 8. 1907.

Received March 5. 1907

The fo
had for so

Vol. 2

E. G. Pec

Vol. 3

Attides, "

Vol. 2
 1994

Vol

Mexico.¹⁷

¹ *The Wisconsin Archeologist*,² Vol. I, No. 1, Oct., 1901, ... 25 cents.

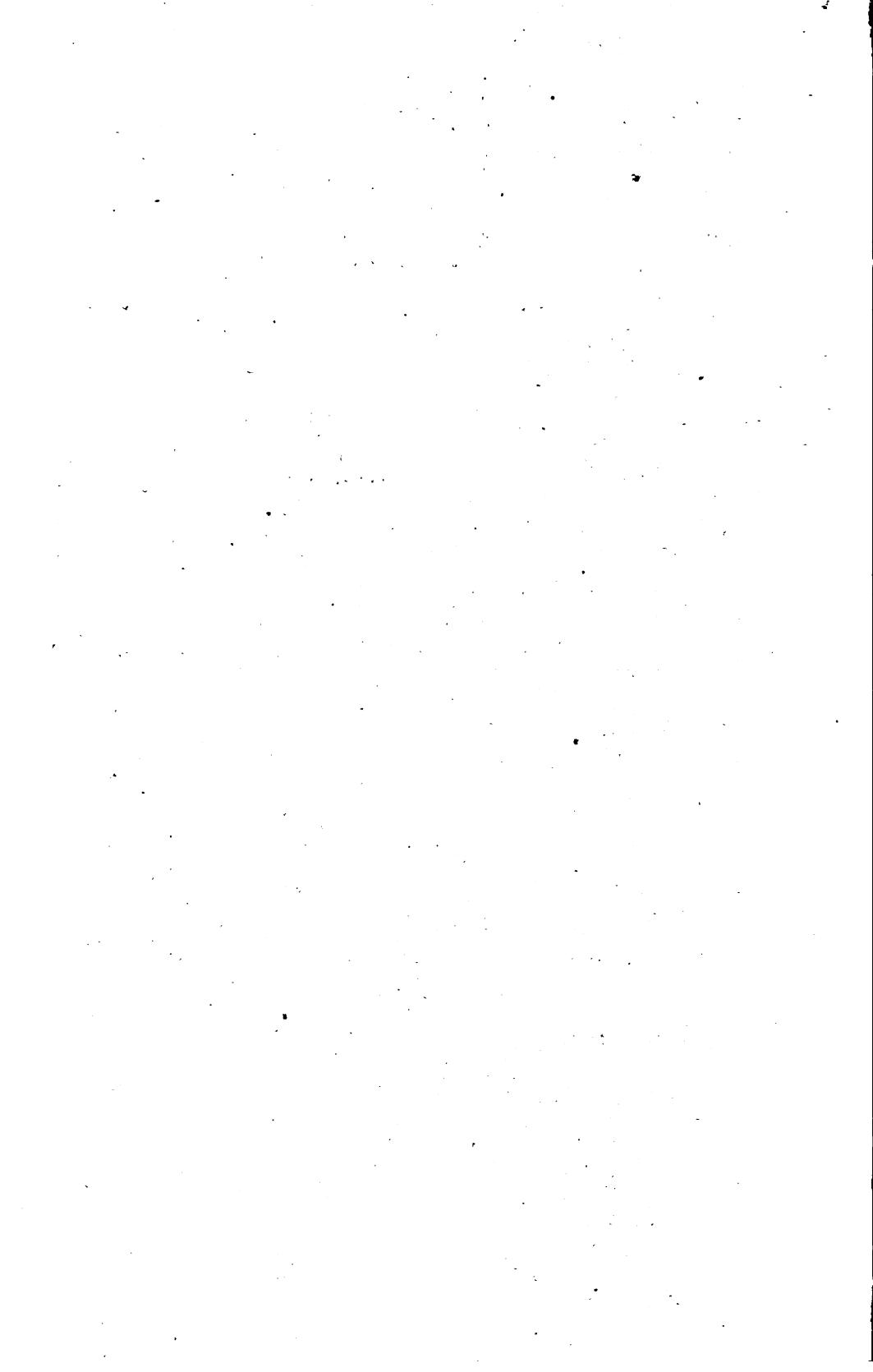
					I. No. 2, Jan., 1902.....	25	48
--	--	--	--	--	---------------------------	----	----

15	11	10	38	1, No. 3, Apr., 1902	25	11
				2, No. 4, July, 1902	25	11

II	II	III	IV	V	J. No. 4, July, 1952, ...	30	22
					II, No. 1, Oct. 1959.	35	23

II, NO. 1, GC low, 100°C, 1 min.

This publication is now issued by the Wisconsin Archeological Society.



VED

L. Soc. 120. W. S. 16

MAY 16 1907

BODY MUSEUM.

Vol. 5 (New Series)

APRIL, 1907

No. 2

BULLETIN

OF THE

**WISCONSIN
NATURAL HISTORY
SOCIETY**

EDITED BY THE SECRETARY

==

CONTENTS:

Proceedings.

Notes on a New Guest-ant (*Leptothorax glacialis*)

and the Varieties of *Myrmica brevinodis* - William Morton Wheeler

Wisconsin Flowers and Their Pollination—II - S. Graenicher

Notes and Descriptions of North American Para-

sitic Hymenoptera—IV - - - - Charles Thomas Brues

On the Fertilization of the Eggs of the Asterias

and *Arbacia* - - - - Ellen Torelle

A New Apiocera from South Africa - - - A. L. Melander

Additions to the Lepidopterous Fauna of Mil-

waukee County - - - - Richard A. Muttkowski

Briefer Articles - - - -

MILWAUKEE, WISCONSIN.
THE EDW. KEOGH PRESS.

RECEIVED

MAY 16 1907

PEABODY MUSEUM.

The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6, 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Brues, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....551 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, Geo. W. Peckham,
Chas. E. Monroe.

REGULAR MEETINGS.

These are all held on the last Thursday of each month, except July and August, in the trustees' room in the Public Museum Building, Milwaukee.

PUBLICATION.

The "Bulletin of the Wisconsin Natural History Society."

MEMBERSHIP DUES.

City Members, \$3.00 per annum; Non-resident Members, \$2.00 per annum; Life Members, one payment of fifty dollars.

PRICE LIST OF PUBLICATIONS.

Orders and remittances should be addressed to the General Secretary, Public Museum, Milwaukee, Wis.

Bericht des Naturhistorischen Vereins von Wisconsin, 1871, 1873, 1874, 1876, each.....	10 cents
Jahresbericht des Naturhistorischen Vereins von Wisconsin, 1876-77, 1877-78, 1879-80, 1880-81, each	10 cents

Proceedings of the Natural History Society of Wisconsin, Apl. 6, '85, to Dec. 7, '85; Jan. 11, '86, to Dec. 13, '86; Mar. 14, '87, to Dec. 19, '87; Jan. 23, '88, to Dec. 17, '88, each	15 cents
---	----------

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. I, No. 1, Jan., 1900; Vol. I, No. 2, Apr., 1900; Vol. I, No. 3, July, 1900; Vol. I, No. 4, Oct., 1900; Vol. II, No. 1, Jan., 1902; Vol. II, No. 2, Apr., 1902; Vol. II, No. 3, July, 1902; Vol. II, No. 4, Oct., 1902, each	50 cents

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, Triple number, Jan., Apr. and July, 1903.....	\$1.00

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, No. 4, Nov., 1905; Vol. IV, Nos. 1-2, Apr., 1906; Vol. IV, No. 3, July, 1906; Vol. IV, No. 4, Oct., 1906; Vol. V, No. 1, Jan., 1907; Vol. V, No. 2, Apr., 1907, each	50 cents

The following Occasional Papers published by the Society may be had for seventy-five cents apiece:

Vol. 2, No. 1, "Ant-like Spiders of the Family Attidæ," G. W. & E. G. Peckham, 1892.

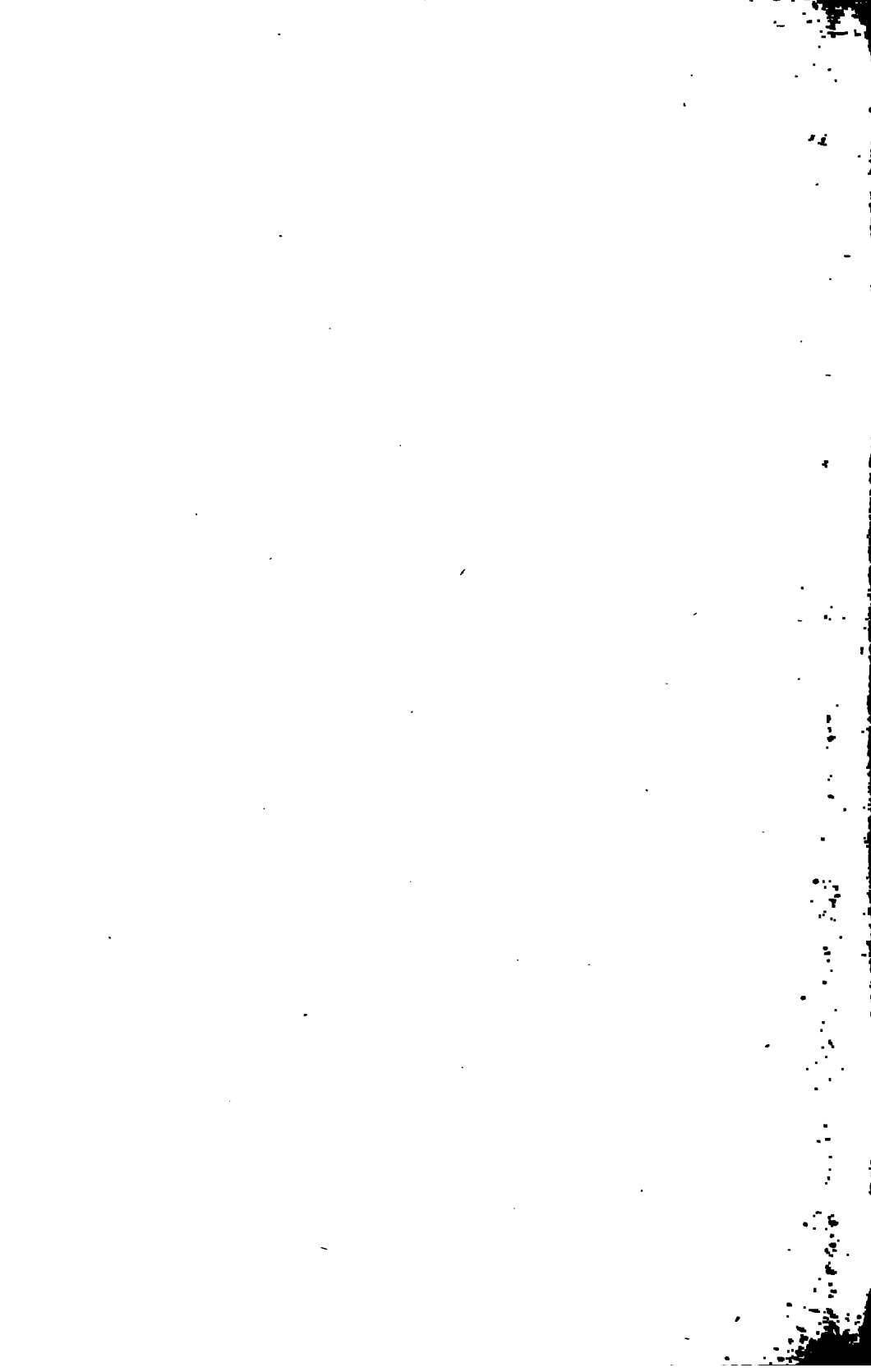
Vol. 2, No. 2, "Spiders of the Marptusa Group of the Family Attidæ," G. W. & E. G. Peckham, Nov., 1894.

Vol. 2, No. 3, "Spiders of the Homalattus Group of the Family Attidæ," G. W. & E. G. Peckham, Dec., 1895.

Vol. 3, "Spiders of the Family Attidæ from Central America and Mexico," G. W. & E. G. Peckham, April, 1896.

"The Wisconsin Archeologist," Vol. I, No. 1, Oct., 1901; Vol. I, No. 2, Jan., 1902; Vol. I, No. 3, Apr., 1902; Vol. I, No. 4, July, 1902; Vol. II, No. 1, Oct., 1902, each.....	25 cents
---	----------

This publication is now issued by the Wisconsin Archeological Society of Milwaukee, from whom the later volumes may be obtained.



L. Soc. 120. W.S. 11
RECEIVED

OCT 1 1907

PLABODY MUSEUM

Vol. 58 (New Series)

JULY, 1907

No. 3

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY

EDITED BY THE SECRETARY

CONTENTS:

Proceedings.

Observations on the Nesting Habits of *Gorytes canaliculatus*

- George P. Barth

Notes and Descriptions of North American Parasitic Hymenoptera

- Charles T. Brues

Briefer Articles.

MILWAUKEE, WISCONSIN.
THE EDW. KEOGH PRESS.

Entered as second-class matter, Oct. 24, 1906, at the post-office, Milwaukee, Wis., under Act of Congress of July 16, 1894. (Issued quarterly.)

The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6. 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Bruen, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....551 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, Geo. W. Peckham,
Chas. E. Monroe.

REGULAR MEETINGS.

These are all held on the last Thursday of each month, except July and August, in the trustees' room in the Public Museum Building, Milwaukee.

PUBLICATION.

The "Bulletin of the Wisconsin Natural History Society."

MEMBERSHIP DUES.

City Members, \$3.00 per annum; Non-resident Members, \$2.00 per annum; Life Members, one payment of fifty dollars.

PRICE LIST OF PUBLICATIONS.

Orders and remittances should be addressed to the General Secretary, Public Museum, Milwaukee, Wis.

Bericht des Naturhistorischen Vereins von Wisconsin, 1871, 1873, 1874, 1876, each.....	10 cents
Jahresbericht des Naturhistorischen Vereins von Wisconsin, 1876-77, 1877-78, 1879-80, 1880-81, each	10 cents

Proceedings of the Natural History Society of Wisconsin; Apl. 6, '85, to Dec. 7, '85; Jan. 11, '86, to Dec. 13, '86; Mar. 14, '87, to Dec. 19, '87; Jan. 23, '88, to Dec. 17, '88, each	15 cents
---	----------

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. I, No. 1, Jan., 1900; Vol. I, No. 2, Apr., 1900; Vol. I, No. 3, July, 1900; Vol. I, No. 4, Oct., 1900; Vol. II, No. 1, Jan., 1902; Vol. II, No. 2, Apr., 1902; Vol. II, No. 3, July, 1902; Vol. II, No. 4, Oct., 1902, each	50 cents

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, Triple number, Jan., Apr. and July, 1903.....	\$1.00

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, No. 4, Nov., 1905; Vol. IV, Nos. 1-2, Apr., 1906; Vol. IV, No. 3, July, 1906; Vol. IV, No. 4, Oct., 1906; Vol. V, No. 1, Jan., 1907; Vol. V, No. 2, Apr., 1907; Vol. V, No. 3, July, 1907, each.....	50 cents

The following Occasional Papers published by the Society may be had for seventy-five cents apiece:

Vol. 2, No. 1, "Ant-like Spiders of the Family Attidæ," G. W. & E. G. Peckham, 1892.

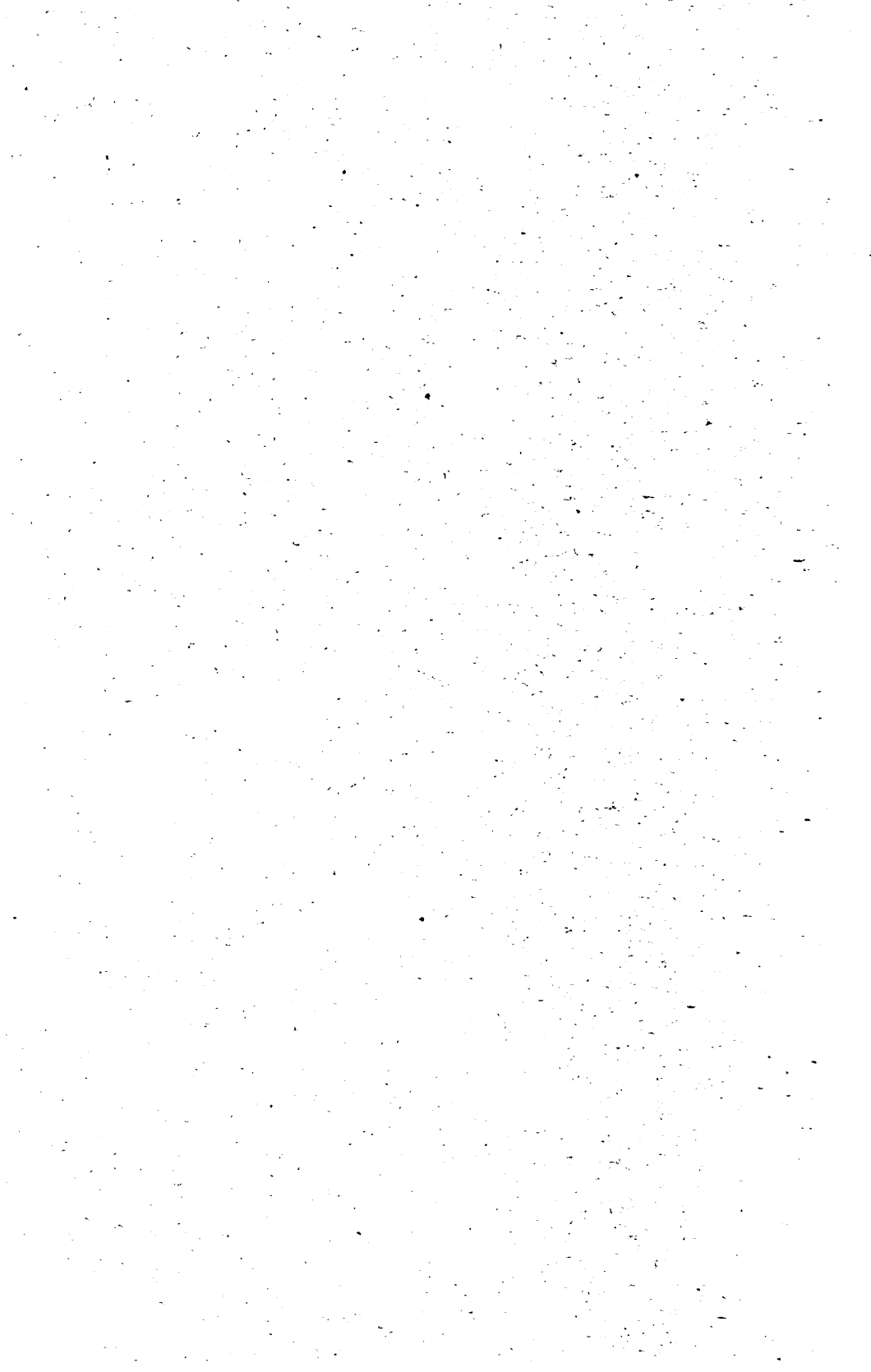
Vol. 2, No. 2, "Spiders of the Marptusa Group of the Family Attidæ," G. W. & E. G. Peckham, Nov., 1894.

Vol. 2, No. 3, "Spiders of the Homalattus Group of the Family Attidæ," G. W. & E. G. Peckham, Dec., 1895.

Vol. 3, "Spiders of the Family Attidæ from Central America and Mexico," G. W. & E. G. Peckham, April, 1896.

"The Wisconsin Archeologist," Vol. I, No. 1, Oct., 1901; Vol. I, No. 2, Jan., 1902; Vol. I, No. 3, Apr., 1902; Vol. I, No. 4, July, 1902; Vol. II, No. 1, Oct., 1902, each.....	25 cents
---	----------

This publication is now issued by the Wisconsin Archeological Society of Milwaukee, from whom the later volumes may be obtained.



L. Soc. 120 U.S. 116
RECEIVED

APR 8 1908

PLABODY MUSEUM.

Vol. 5 (New Series)

DECEMBER, 1907

No. 4

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY

EDITED BY THE SECRETARY

CONTENTS:

Proceedings.

- | | |
|---|--------------------|
| Check List of the Flora of Milwaukee County, - | - Howland Russel |
| A New Species of <i>Psen</i> , - - - - - | - Henry L. Viereck |
| On the Nesting Habit of <i>Psen barthi</i> , - - - | - George P. Barth |
| List of Members of the Wisconsin Natural History Society. | |
| Index to Vol. V. | |

MILWAUKEE, WISCONSIN.

THE EDW. KEOGH PRESS.

The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6, 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Brues, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....351 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, Geo. W. Peckham,
Chas. E. Monroe.

REGULAR MEETINGS.

These are all held on the last Thursday of each month, except July and August, in the trustees' room in the Public Museum Building Milwaukee.

PUBLICATION.

The "Bulletin of the Wisconsin Natural History Society."

MEMBERSHIP DUES.

City Members, \$3.00 per annum; Non-resident Members, \$2.00 per annum; Life Members, one payment of fifty dollars.

PRICE LIST OF PUBLICATIONS.

Orders and remittances should be addressed to the General Secretary, Public Museum, Milwaukee, Wis.

Bericht des Naturhistorischen Vereins von Wisconsin, 1871,	
1873, 1874, 1876, each.....	10 cents
Jahresbericht des Naturhistorischen Vereins von Wisconsin,	
1876-77, 1877-78, 1879-80, 1880-81, each	10 cents

Proceedings of the Natural History Society of Wisconsin, Apl.	
6, '85, to Dec. 7, '85; Jan. 11, '86, to Dec. 13, '86; Mar. 14, '87,	
to Dec. 19, '87; Jan. 23, '88, to Dec. 17, '88, each	15 cents

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. I, No. 1, Jan., 1900; Vol. I, No. 2, Apr., 1900; Vol. I,	
No. 3, July, 1900; Vol. I, No. 4, Oct., 1900; Vol. II, No. 2,	
Apr., 1902; Vol. II, No. 3, July, 1902; Vol. II, No. 4, Oct.,	
1902, each.....	50 cents

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, Triple number, Jan., Apr. and July, 1903:.....	\$1.00

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, No. 4, Nov., 1905; Vol. IV, Nos. 1-2, Apr., 1906;	
Vol. IV, No. 3, July, 1906; Vol. IV, No. 4, Oct., 1906; Vol.	
V, No. 1, Jan., 1907; Vol. V, No. 2, Apr., 1907; Vol. V, No.	
3, July, 1907, Vol. V, No. 4, Dec., 1907; each.....	50 cents

The following Occasional Papers published by the Society may be had for seventy-five cents apiece:

Vol. 2, No. 1, "Ant-like Spiders of the Family Attidæ," G. W. & E. G. Peckham, 1892.

Vol. 2, No. 2, "Spiders of the Marptusa Group of the Family Attidæ," G. W. & E. G. Peckham; Nov., 1894.

Vol. 2, No. 3, "Spiders of the Homalattus Group of the Family Attidæ," G. W. & E. G. Peckham, Dec., 1895.

Vol. 3, "Spiders of the Family Attidæ from Central America and Mexico," G. W. & E. G. Peckham, April, 1896.

"The Wisconsin Archeologist." Vol. I, No. 1, Oct., 1901; Vol. I,	
No. 2, Jan., 1902; Vol. I, No. 3, Apr., 1902; Vol. I, No. 4,	
July, 1902; Vol. II, No. 1, Oct., 1902, each.....	25 cents

This publication is now issued by the Wisconsin Archeological Society of Milwaukee, from whom the later volumes may be obtained.



RECEIVED

JUL 1908

L. Soc. 120, WIS.

PEABODY MUSEUM.

Vol. 6

APRIL, 1908

Nos. 1—2

BULLETIN

OF THE

WISCONSIN NATURAL HISTORY SOCIETY

EDITED BY THE SECRETARY

CONTENTS:

Proceedings.

- Some Fossil Plants from the Middle Devonian
of Milwaukee, Wisconsin, - - - D. P. Penhallow
- A Preliminary List of Wisconsin Mammals, - Hartley H. T. Jackson
- Fossil Cercopidae (Homoptera), - - - T. D. A. Cockerell
- The Pseudoscorpions of Texas, - - - Nathan Banks
- A Rapid Melanistic and Subsequent Partial
Albinistic Change in a Caged Robin, - - Henry L. Ward
- Notes and Descriptions of North American
Parasitic Hymenoptera. VI. - - - Charles T. Brues
- Review of the Dragon-flies of Wisconsin, - Richard A. Muttkowski
- An Addition to the Avifauna of Wisconsin, - Henry L. Ward

MILWAUKEE, WISCONSIN.
THE EDW. KEOGH PRESS.

The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6, 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Brues, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....551 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, Geo. W. Peckham,
Chas. E. Monroe.

REGULAR MEETINGS.

These are all held on the last Thursday of each month, except July and August, in the trustees' room in the Public Museum Building Milwaukee.

PUBLICATION.

The "Bulletin of the Wisconsin Natural History Society."

MEMBERSHIP DUES.

City Members, \$3.00 per annum; Non-resident Members, \$2.00 per annum; Life Members, one payment of fifty dollars.

PRICE LIST OF PUBLICATIONS.

Orders and remittances should be addressed to the General Secretary, Public Museum, Milwaukee, Wis.

Bericht des Naturhistorischen Vereins von Wisconsin, 1871,	
1873, 1874, 1876, each.....	10 cents
Jahresbericht des Naturhistorischen Vereins von Wisconsin,	
1876-77, 1877-78, 1879-80, 1880-81, each	10 cents

Proceedings of the Natural History Society of Wisconsin, Apl	
6, '85, to Dec. 7, '85; Jan. 11, '86, to Dec. 13, '86; Mar. 14, '87,	
to Dec. 19, '87; Jan. 23, '88, to Dec. 17, '88, each	15 cents

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. I, No. 1, Jan., 1900; Vol. I, No. 3, July, 1900; Vol. I,	
No. 4, Oct., 1900; Vol. II, No. 2, Apr., 1902; Vol. II, No. 4,	
Oct., 1902, each.....	50 cents

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, Triple number, Jan., Apr. and July, 1903.....	\$1.00

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, No. 4, Nov., 1905; Vol. IV, Nos. 1-2, Apr., 1906;	
Vol. IV, No. 3, July, 1906; Vol. IV, No. 4, Oct., 1906; Vol.	
V, No. 1, Jan., 1907; Vol. V, No. 2, Apr., 1907; Vol. V, No.	
3, July, 1907, Vol. V, No. 4, Dec., 1907; each.....	50 cents
Vol. VI, Nos. 1-2, April, 1908.....	\$1.00

The following Occasional Papers published by the Society may be had for seventy-five cents apiece:

Vol. 2, No. 1, "Ant-like Spiders of the Family Attidæ," G. W. & E. G. Peckham, 1892.

Vol. 2, No. 2, "Spiders of the Marptusa Group of the Family Attidæ," G. W. & E. G. Peckham, Nov., 1894.

Vol. 2, No. 3, "Spiders of the Homalattus Group of the Family Attidæ," G. W. & E. G. Peckham, Dec., 1895.

Vol. 3, "Spiders of the Family Attidæ from Central America and Mexico," G. W. & E. G. Peckham, April, 1896.

"The Wisconsin Archeologist," Vol. I, No. 1, Oct., 1901; Vol. I,	
No. 2, Jan., 1902; Vol. I, No. 3, Apr., 1902; Vol. I, No. 4,	
July, 1902; Vol. II, No. 1, Oct., 1902, each.....	25 cents

This publication is now issued by the Wisconsin Archeological Society of Milwaukee, from whom the later volumes may be obtained.

A

L. Soc. 120. 128. 16

MAY 1 1908

PEABODY MUSEUM.

Vol. 6

OCTOBER, 1908

Nos. 3-4

BULLETIN

OF THE

Wisconsin Natural History Society

PUBLISHED WITH THE
COOPERATION OF THE

Public Museum of the City of Milwaukee

EDITED BY CHARLES T. BRUES

CONTENTS:

Proceedings.	
Notes on Wisconsin Mammals, ...	By N. Hollister
The Last Records of Deer in Walworth County, Wisconsin, ...	By N. Hollister
The American Elk in Southern Wisconsin, ...	By Henry L. Ward
The Nesting of <i>Anacrabro ocellatus</i> Pack	By George P. Barth
Notes and Descriptions of North American Parasitic	
Hymenoptera. VII	By Charles T. Brues
A Summer's Insect Collecting	By Richard Muttkowski
A New Fossil Grass from the Miocene of Florissant, Colorado	By Charles T. and Beirne B. Brues
Briefer Articles.	
Plant Family Reference List, ...	By Herbert Clowes
The Generic Name <i>Rooseveltia</i> , ...	By George W. Peckham
List of Members of the Wisconsin Natural History Society.	

MILWAUKEE, WISCONSIN.
THE EDW. KEOGH PRESS.

Entered as second-class matter, Oct. 24, 1906, at the post-office, Milwaukee, Wis., under Act of Congress of July 16, 1894. (Issued quarterly.)

The Wisconsin Natural History Society,

MILWAUKEE, WISCONSIN.

ORGANIZED MAY 6. 1857.

OFFICERS AND DIRECTORS.

Edgar E. Teller, President.....165 27th Street, Milwaukee.
Henry L. Ward, Vice-President.....Public Museum, Milwaukee.
Charles T. Brues, General Secretary.....Public Museum, Milwaukee.
William Finger, Treasurer.....297 12th Street, Milwaukee.
Sigmund Graenicher.....551 7th Street, Milwaukee.

PUBLISHING COMMITTEE.

Henry L. Ward, Geo. W. Peckham,
Chas. E. Monroe.

MEETINGS.

Regular meetings are held on the last Thursday of each month, except July and August, in the trustees' room in the Public Museum Building, Milwaukee, and meetings of the combined sections on the second Thursday of each month, at the same place.

PUBLICATION.

The "Bulletin of the Wisconsin Natural History Society."

MEMBERSHIP DUES.

Active Members, \$3.00 per annum; Corresponding Members, \$2.00 per annum; Life Members, one payment of fifty dollars.

PRICE LIST OF PUBLICATIONS.

Orders and remittances should be addressed to the General Secretary, Public Museum, Milwaukee, Wis.

Bericht des Naturhistorischen Vereins von Wisconsin, 1871, 1873, 1874, 1876, each.....	10 cents
Jahresbericht des Naturhistorischen Vereins von Wisconsin, 1876-77, 1877-78, 1879-80, 1880-81, each	10 cents

Proceedings of the Natural History Society of Wisconsin, Apl 6, '85, to Dec. 7, '85; Jan. 11, '86, to Dec. 13, '86; Mar. 14, '87, to Dec. 19, '87; Jan. 23, '88, to Dec. 17, '88, each	15 cents
--	----------

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. I, No. 1, Jan., 1900; Vol. I, No. 3, July, 1900; Vol. I, No. 4, Oct., 1900; Vol. II, No. 2, Apr., 1902; Vol. II, No. 4, Oct., 1902, each.....	50 cents

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, Triple number, Jan., Apr. and July, 1903.....	\$1.00

Bulletin of the Wisconsin Natural History Society (New Series).	
Vol. III, No. 4, Nov., 1905; Vol. IV, Nos. 1-2, Apr., 1906; Vol. IV, No. 3, July, 1906; Vol. IV, No. 4, Oct., 1906; Vol. V, No. 1, Jan., 1907; Vol. V, No. 2, Apr., 1907; Vol. V, No. 3, July, 1907, Vol. V, No. 4, Dec., 1907; each.....	50 cents
Vol. VI, Nos. 1-2, April, 1908; Vol. VI, Nos. 3-4, Oct., 1908,	\$1.00

The following Occasional Papers published by the Society may be had for seventy-five cents apiece:

Vol. 2, No. 1, "Ant-like Spiders of the Family Attidæ," G. W. & E. G. Peckham, 1892.

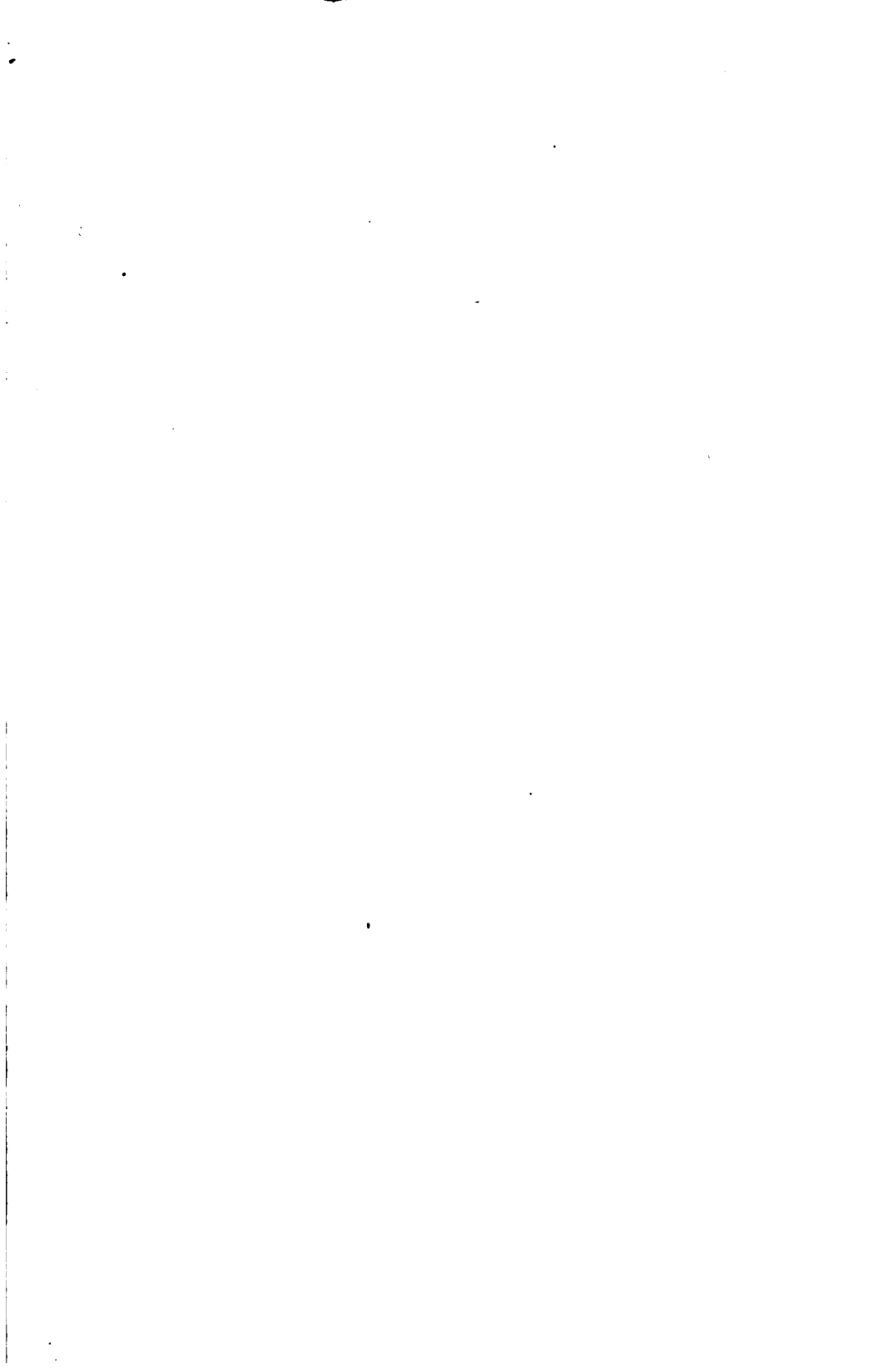
Vol. 2, No. 2, "Spiders of the Marptusa Group of the Family Attidæ," G. W. & E. G. Peckham, Nov., 1894.

Vol. 2, No. 3, "Spiders of the Homalattus Group of the Family Attidæ," G. W. & E. G. Peckham, Dec., 1895.

Vol. 3, "Spiders of the Family Attidæ from Central America and Mexico," G. W. & E. G. Peckham, April, 1896.

"The Wisconsin Archeologist," Vol. I, No. 1, Oct., 1901; Vol. I, No. 2, Jan., 1902; Vol. I, No. 3, Apr., 1902; Vol. I, No. 4, July, 1902; Vol. II, No. 1, Oct., 1902, each.....	25 cents
---	----------

This publication is now issued by the Wisconsin Archeological Society of Milwaukee, from whom the later volumes may be obtained.



TOZZER LIBRARY



3 2044 041 970 385

**This book should be returned
to the Library on or before the
last date stamped below.
Please return promptly.**

